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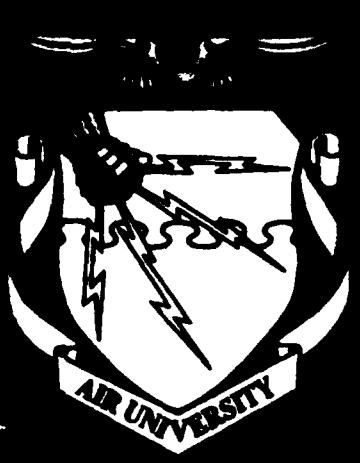

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Rethinking the Air Operations Center

Air Force Command and Control in Conventional War

J. TAYLOR SINK, Lt Col, USAF
School of Advanced Airpower Studies

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Rethinking the Air Operations Center

Air Force Command and Control in Conventional War

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School of Advanced Airpower Studies

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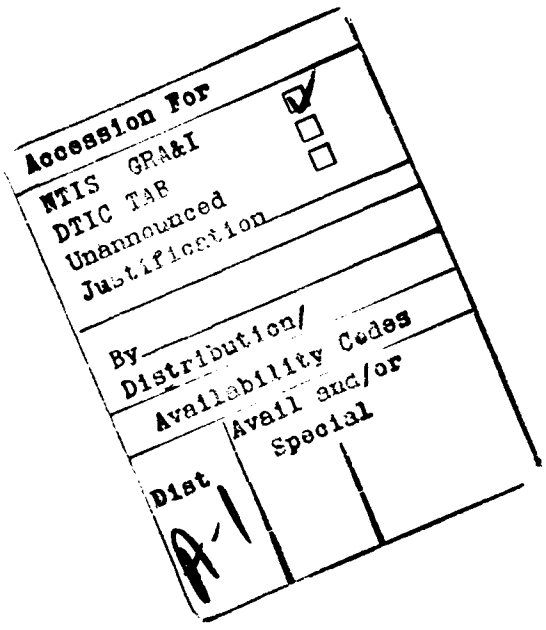

Contents

Illustrations

Figure

Abstract

The Air Operations Center (AOC) is the centerpiece of the Air Force's new command and control (C^2) system for prosecuting theater conventional war. The AOC is a direct outgrowth of the Tactical Air Control Center (TACC). In Vietnam, the TACC mirrored the divided command structure of the US military establishment in Southeast Asia. This resulted in a C^2 system that allowed air power to be responsive to the needs of traditional land campaigns, and yet require extensive planning time for deep interdiction and strategic attacks. Additionally, since a land strategy dictated targeting priorities in South Vietnam, the Air Force's measure of effectiveness in the South was its ability to strike targets requested by ground commanders efficiently. Similarly, agencies other than the Air Force selected and approved deep interdiction and strategic targets during Rolling Thunder. Thus, the Air Force's measure of effectiveness in the North likewise became its efficiency of attacking targets there. Assessment thereby became disconnected from the political and military objectives.

Following the Vietnam War, the Air Force did not conduct a reassessment of the fundamental purposes or theoretical foundations of tactical command and control. Thus, although technology had improved the efficiency of the TACC, the Air Force entered Operation Desert Storm with a C^2 system that doctrinally was little changed from Vietnam. There are two implications. First, the air commander cannot execute responsive strategic conventional air war without disrupting the mission planning process, or without sacrificing his attack plan. In addition, since the value of targets may change drastically over time, the system cannot provide the air commander with an objective means of determining the relative importance of preplanned and "opportunity" targets. Second, assessment remains disconnected from political and military objectives. Despite efforts to improve Battle Damage Assessment, the Air Force's primary measures of effectiveness are still measures of efficiency. Experience in the Persian Gulf War supports both conclusions.

The latest improvements to the Air Operations Center are still below the level where change is most needed. While increasing data capacity and speeding information flow will no doubt improve the efficiency of the AOC, the basic structure requires overhaul. The Air Force must seek doctrinal and organizational means, as well as technological means, to improve its ability to prosecute strategic conventional air war responsively. Additionally, Air Force doctrine must refocus on the need for mission assessment—as opposed to target assessment—to determine whether the air attacks are achieving campaign objectives.

The study concludes with recommendations for rethinking the Air Operations Center. Methods for improving responsiveness include time-value based target analysis, greater use of alert or reserve forces, onboard mission planning, and limited decentralization, with mission-type orders and commander's intent transmitted to

lower echelons. Solutions for improving assessment include delegating target assessment functions to the wings, focusing theater-level intelligence personnel on mission assessment, using statistical and effects-based evaluation techniques, using Air Force Special Operations forces to evaluate target system degradation, and acquiring technology that can conduct "top-down" assessment of the enemy's war-making systems.

About the Author

Lt Col J. Taylor Sink (BS, astronautical engineering, United States Air Force Academy; MS, aeronautics and astronautics, Stanford University) has held flying assignments in F-117A, A-7, A-10, and AT-38B aircraft. Colonel Sink's experience with the Tactical Air Control System began as a second lieutenant at Eielson Air Force Base, Alaska, where he flew the O-2A Skymaster and augmented the 172d Light Infantry Brigade as a ground forward air controller. Since then, he has worked with command and control systems in Asia, Europe, and the Middle East. Colonel Sink flew aboard a KC-135 as an airborne controller for the F-117A during Operation Just Cause, and was F-117A duty officer in the Tactical Air Control Center in Riyadh during the final weeks of Operation Desert Shield. A flight commander during Operation Desert Storm, he flew 21 combat missions in the F-117A. Colonel Sink's combat decorations include the Distinguished Flying Cross and the Air Medal with three Oak Leaf Clusters. He is the 1987 winner of the Harold George Daedalian Foundation Fellowship and is a graduate of the USAF Air Ground Operations School, the Squadron Officer School, the Air Command and Staff College, and the School of Advanced Airpower Studies at Maxwell Air Force Base, Alabama.

Chapter 1

Command and Control—The Problem

> ***Command and Control:*** *The exercise of authority and direction by a properly designated commander over assigned forces in the accomplishment of the mission. Command and control functions are performed through an arrangement of personnel, equipment, communications, facilities, and procedures employed by a commander in planning, directing, coordinating, and controlling forces and operations in the accomplishment of the mission.*
>
> —Dictionary of Military and Associated Terms

The purpose of an air force's command and control system is twofold.[1] First, as an extension of the commander's authority, the system provides the means to direct air forces and supporting elements in order to achieve the unity of effort vital to accomplishing the air commander's military objectives. Second, the system provides the air commander with the breadth and depth of vision needed to understand the situation, the so-called air picture, despite the fog and friction inherent in warfare.[2] Thus, it must provide information not only about the disposition of friendly and enemy forces, but also about the results of actions by those forces, in order for the commander to evaluate his own effectiveness as well as that of the enemy. The US Air Force has traditionally upheld the concept of centralized control of air forces under an air commander at the theater level as the best way to achieve these dual aims.[3] Indeed, this advocacy is tightly intertwined with the history of the USAF in its struggle to gain independence from the Army.

Rooted in the experiences of the First World War and the thinking of the Air Corps Tactical School, the idea of centralized control has been vindicated by historical experience in every major war in which the America's air arm has flown and fought.[4] The experience of the US Army Air Forces in North Africa during the Second World War, specifically problems with disjointed, uncoordinated effort resulting from small packets of air power assigned to field commanders, led to the Army's acceptance of airmen's centralized control concepts.[5] The US Air Force's experience in Korea further bolstered proponents of central control of air assets. In the Korean conflict, the USAF found the coordination arrangements with the Navy and Marines unsatisfactory, and worked with limited success to centralize command of all air forces in-theater.[6] By Vietnam, the Air Force's mechanism for commanding and controlling tactical air forces was highly developed. The "ground side" of the Tactical Air Control System allocated air sorties to support both the ground campaign in the South, as well as the interdiction

and strategic air campaigns of Rolling Thunder and Linebackers I and II in the North.

The 1991 war in the Middle East offered a new template for modern conflict—strategic conventional war. "Strategic," because many of the targets struck by air were unrelated to immediate battlefield outcomes, and "conventional," since these targets were attacked with high-explosive (and in some cases, nonlethal) weapons. Since the advent of atomic weapons, most air force leaders thought of strategic attacks primarily in nuclear terms. In fact, Air Force doctrine did not even include strategic attack as a mission for the conventional bomber force.[7] In short, there was "no such animal" as strategic conventional war. Yet, six weeks of air war in the Gulf, followed by a short, conclusive ground campaign, energized Air Force proponents of strategic *conventional* attack against the sources of enemy military capability.[8] For 37 days and nights, this largely independent air campaign was fought with the Tactical Air Control System (TACS), a command and control (C^2) structure largely designed to support traditional tactical air operations—that is, those aimed toward achieving victory on the land battlefield.[9] This system is worth examining, since the demise of the Strategic Air Command makes the central headquarters of the TACS—the Tactical Air Control Center (TACC)—which has been renamed the Air Operations Center—or AOC—the only command and control system in the Air Force capable of planning *and* executing *any* kind of conventional war, strategic or tactical. To understand fully the implications of this fact, this paper will examine the evolution of our conventional air command and control mechanism, and compare that system with the likely demands of future warfare. Is the AOC up to the task of implementing this new vision of regional conventional war? Will the AOC be able to adapt to the changing requirements of future wars, which some have dubbed as "information warfare" and "the military-technical revolution?"[10]

To answer these questions, an investigation should focus on organizational and doctrinal issues, rather than technology. Although the pace of technological change dictates that we consider advances in physical command and control systems, evaluation of the effectiveness of any C^2 structure must begin with its conceptual foundations. As Gen Michael Loh, commander of Air Combat Command, has noted, "If our national military strategy and supporting force structure have changed, so are the systems we say are required to meet the needs generated by the new paradigm."[11] The evidence so far suggests that while much thought has been given to the technology of implementing command and control, little has been done to examine fundamental concepts driving our command and control systems. In fact, this examination will show that command and control improvements have focused almost entirely on technology issues, with little thought toward the fundamental concepts driving the system. What are these concepts underlying our vision of command and control, and why are they so important?

An air force's command and control system must accomplish three main tasks in order for the commander to conduct air-to-ground operations rationally—Intelligence Analysis, Targeting, and Assessment.[12] Analysis identifies and evaluates the target systems which are most critical to the functioning of the enemy's war capability, and are most vulnerable to attack from the air. The targeting function matches the commander's objectives and guidance to individual components comprising these systems for attack with specified weapons, paying close attention to certain key elements which are the linchpins of critical or vulnerable systems. Finally, assessment evaluates the effectiveness of the attacks, as well as the impact of the loss of these targets and target systems on the enemy's military capability. Assessment completes the loop, and provides vital feedback to the commander for improving and adjusting his attack plan. Although there are many other tasks the AOC must accomplish (such as execution and coordination functions), these three are the most crucial to the air commander's task of planning, executing, and evaluating theater air operations. These functions must be performed effectively for the commander to conduct coherent air offensives.

Does this vision of how we will use air power coincide with the control structures which have evolved? My contention is that it does not, and current planned improvements to the AOC will not solve its inherent structural problems. The AOC evolved from a system which optimized air support of land operations, the Vietnam-era TACC. This genesis has led to serious discontinuities in the Intelligence-Targeting-Assessment Cycle, which cannot be corrected by technical solutions. *Only a top-to-bottom examination of how air power works in theater war can guide us in designing control structures that will meet the challenges of the future.*

This paper will provide that examination, and offer recommendations for fundamental and lasting improvements to our theater war control structures. The next chapter discusses what an ideal air-to-ground C^2 system should be able to do—not from a technical viewpoint, but from a theoretical perspective. Chapter 3 looks at how and why the TACC evolved as it did from the peculiar requirements of the Vietnam War. Chapter 4 compares that system with our ideal system to identify areas for improvement. Chapter 5 describes developments in the Tactical Air Command after Operation Desert Storm, and evaluates currently proposed improvements to the AOC, specifically, the new Contingency TACS Automated Planning System (CTAPS). The final chapter draws together conclusions in order to recommend a course for the future. Perhaps the most profound conclusion is that while technical improvements are vital for keeping pace with changing military requirements, the Air Force has potentially the most to gain from conceptual and organizational changes to both the Air Operations Center and its subordinate elements. The study begins with a look at an ideal C^2 structure.

Notes

1. Joint Pub 1-02, *Department of Defense Dictionary of Military and Associated Terms*, 1 December 1989, 77.

2. Air Force Manual (AFM) 1-1, *Basic Aerospace Doctrine of the United States Air Force*, vol. 2, March 1992, 130–31.

3. See Barry D. Watts, *The Foundations of U.S. Air Doctrine: The Problem of Friction in War* (Maxwell AFB, Ala.: Air University Press, December 1984), for a comprehensive discussion of friction in air warfare.

4. AFM 1-1, vol. 2, March 1992, 113–15.

5. The most recent example of this is the Persian Gulf War, where all air resources were commanded and controlled at the theater level by Gen H. Norman Schwarzkopf, through his Joint Air Force Component commander (JFACC), Lt Gen Charles A. Horner. See Schwarzkopf, *It Doesn't Take a Hero: The Autobiography*, with Peter Petre (New York: Linda Grey Bantam Books, 1992), and Horner, "The Air Campaign," *Military Review*, September 1991, 17–27. Gen William Momyer, among others, disparages the disjointed command arrangements that existed during the Vietnam War. See his *Air Power in Three Wars (WWII, Korea, Vietnam)* (Washington, D. C.: Superintendent of Documents, 1978).

6. Field Manual (FM) 100-20, *Command and Employment of Air Power*, 21 July 1943, 1–2.

7. Robert F. Futrell, *The United States Air Force in Korea: 1950–1953*, rev. ed. (Washington, D.C.: Office of Air Force History, 1983).

8. Thomas A. Keaney, *Strategic Bombers and Conventional Weapons: Airpower Options* (Fort Lesley J. McNair: National Defense University Press, 1984).

9. One of those proponents was Col John A. Warden III, head of the "Checkmate" division of the Air Staff. The division's plan was accepted by General Schwarzkopf in August 1990 as the foundation for offensive air operations against Iraq. See James P. Coyne, "Plan of Attack," *Air Force Magazine*, April 1992, 40–46.

10. The air-to-surface functions of the TACC were designed to prosecute air interdiction, close air support, and tactical reconnaissance. These were by no means the only functions of the Air Force's tactical command and control system. The TACC also planned and executed counterair missions, which are dedicated to gaining and maintaining control of the air. Occasionally, the air-to-surface and air-to-air functions of the TACC overlapped. For example, a single Control and Reporting Post might direct attack sorties to their surface target, while also directing fighters against enemy aircraft. See Lt Col John J. Lane, Jr., *Command and Control and Structures in Southeast Asia*, The Air War in Indochina, vol. 1, Monograph 1 (Maxwell AFB, Ala.: Airpower Research Institute, 1981), 16–19, for the structure of the TACC as it existed during the Vietnam War. Also, AFM 2-1, *Tactical Air Operations—Counter Air, Close Air Support, and Air Interdiction*, 2 May 1969, was current as of the Persian Gulf war (and is still current as of this writing).

11. Memorandum for Secretary of Defense, Deputy Secretary of Defense, subject: Assessment of the Military-Technical Revolution (U), 15 July 1992, 22–23. (Secret) Information extracted is unclassified.

12. Gen John M. Loh, "Advocating Mission Needs in Tomorrow's World," *Airpower Journal* (Spring 1992): 6.

13. These are the most important functions for translating a commander's air strategy into an executable attack plan, and modifying that plan based on perceived results. A more detailed discussion of these functions, along with the rationale for choosing them, follows in chap. 2.

Chapter 2

Concept for Command and Control
A Simplified Structure

Command and control is not a collection of sensors, processors, displays, and data links. Rather, command and control is an extension of basic human decision processes by means of procedures, organization, and equipment.

—Joseph G. Wohl
IEEE Transactions on Systems, Man, and Cybernetics

Selection of targets for attack is the *sine qua non* of air-to-ground operations. No target means, simply, no air power, since the sole reason for an air force is to apply force from the air. The target is the *objective*, the point at which air forces achieve a concrete, measurable result. Even if attacks on the proper targets are only partially successful, the result may still lead to victory. Conversely, fully effective strikes on poorly selected targets will, at best, merely waste effort, and are quite likely to be counterproductive. Thus, choosing the right points to direct air power is crucial to the success of the air operation. Even then, it may not be possible to attack the "correct" targets, for a variety of reasons.[1]

Therefore, translation of military objectives into an executable target list is a primary responsibility of the air commander. In theater war, the air commander's authority derives from the theater commander, who is ultimately responsible for translating the political objectives and war aims into military objectives—the conditions for war termination.[2] Ideally, there exists a hierarchy of aims which ultimately results in a target list for the air forces (fig. 1).

In regional war, the theater commander translates political aims into military goals via the military component of grand strategy, although the political goals are often determined in part by what is militarily feasible.[3] He and his component commanders then devise strategies to achieve those goals, and plan military operations to implement the strategies. In air forces, these

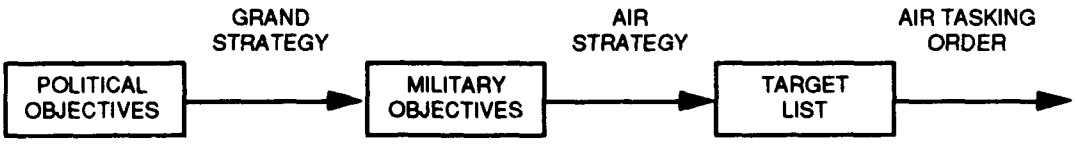

Figure 1. From Political Goals to Air Tasking Order

plans are the air commander's vision of future operations—the "Air Strategy"—which ultimately takes physical shape in the form of a target list. The air commander prioritizes the target list in time and divides the planned operations among the various air units. The resulting Air Tasking Order (ATO) tells each unit who will attack what. Since war is a dynamic, ever-changing activity, the ATO is normally good for a set period of time, say, 24 hours. Then the commander's staff issues a new ATO for the next time period.

Theoretically, the exhaustion of the air commander's target list equates to the achievement of the theater commander's strategy and the accomplishment of the overall political aims. Since every military action is directed toward the achievement of the political objectives, the design of any command and control structure for conducting air war should facilitate this ultimate end (fig. 2). Not surprisingly, the associated command and control systems tend to mirror the organization of the force, and control the implementation of that force.[4]

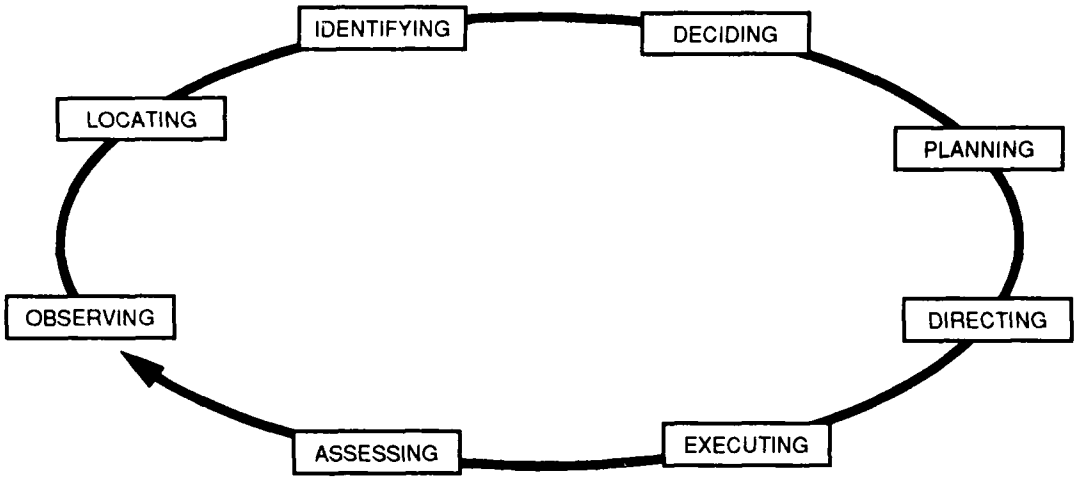

Figure 2. The Command and Control Cycle

The functions of a command and control system are observing, locating, identifying, deciding, planning, directing, executing, and assessing.[5] Observing, locating, and identifying target systems comprise Intelligence Analysis. The concept here is to identify the element and structure of the enemy's war-making capabilities, and understand how individual targets making up these systems fit in to the enemy's plan for achieving his aims.[6] Historically, this function has required a substantial knowledge and understanding of the enemy's political, economic, and military organization as well as the ability to combine diverse sources of intelligence data to produce meaningful information. For example, identification of the various components of the German war machine in World War II was relatively easy. However, the relationships between these elements was never fully understood by any of the organizations tasked with creating target lists for the Combined Bomber offensive. The fact that the transportation of coal was

the most critical element of the German war economy went almost completely unnoticed until mid-1944, even though substantial open-source information on this aspect of the German economic structure was widely available.[7] Thus, an effective analysis function combines data gathering tasks with a wider responsibility of integrating the information to produce a meaningful picture of the strengths and vulnerabilities of the enemy's war-making apparatus, as well as a detailed schematic of the relationships between the various (often interdependent) components. Once the crucial systems are identified and understood, reconnaissance can further locate individual elements of the various potential target systems.

The targeting function then comes to the fore, focusing on planning and directing. Targeting is the complex process of selecting specific objectives for attack by various means, and matching those objectives with weapons and delivery systems in order to achieve the commander's military goals.[8] Targeting requires detailed analysis of the targeted system to identify critical and vulnerable elements, select aim points, and assign weapons or nonlethal techniques against the aim point. Ideally, destruction of crucial individual targets leads to the collapse of the associated target system. The air objective is achieved when the target system "dies," and the air force progresses toward attainment of the overall military and political goals. The strategic targeting function has historically been hampered by lack of comprehensive air power theory. In the absence of such a theory, knowledge of which targets are most important, at what time, and for what objectives, can only be based on an analysis of the expected destruction or damage to enemy capabilities. In other words, whatever the commander believes, based on the analysis, will do the most harm to the enemy's war-making system becomes the priority target. Hopefully, subsidiary effects will be cumulative and assist in defeating the foe. Since every potential enemy's society is unique, every war-making political, economic, and social organization is unique, and thus requires tailored analysis. This type of detailed planning is a dynamic process. Even as the analysis is completed, the military situation may significantly change, requiring continual revision and adjustment of the plan.

Once the air commander has designed the attack plan, he directs his subordinate forces to neutralize targets, based on the concept of centralized control. Centralized control at the theater level is important because the air commander can focus air effort when and where it is needed; that is, he can allocate his resources efficiently. In addition, the air commander can optimize and coordinate capabilities of various weapons to achieve the best overall effect.[9] Based on internal and external conditions, such as the capabilities and numbers of the various aircraft, the strength of enemy defenses, the weather, and so forth, the air commander will allocate missions to the unit best suited. The means of direction—the control structure—must be secure and responsive. It must be secure from interception and exploitation by the enemy, since it contains the air attack plan. It also must be responsive, because a centralized control structure that is too slow to react to changing conditions impedes flexibility and introduces friction into the targeting/execution cycle. Lastly,

tasking must allow time for subordinate units to plan missions that exploit enemy uncertainty of when and where the attack will occur. Generally, the more time available, the better planned the mission. A typical mission planning cycle is shown in Figure 3. Not only will thorough planning optimize the attack against enemy defenses, but aircrews flying the mission will also have more time for devising alternative courses of action to deal with both uncertainties (the fog of war) as well as the unforeseen occurrences that inevitably accompany real war (friction). In fact, this ability to preplan is the primary advantage of the attacker over the defender—the attacker knows when and where he will strike, and can stack the odds in his favor, while the defender must remain alert to attack at any time and from any direction.[10]

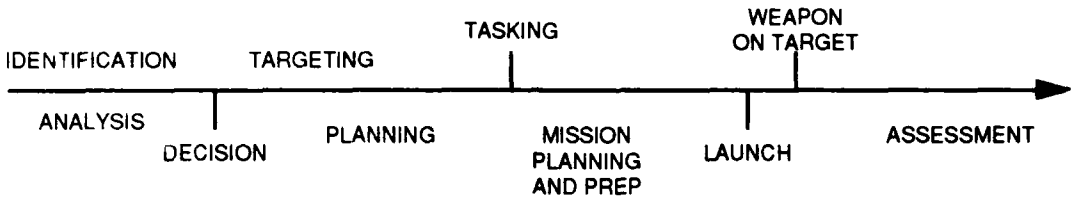

Figure 3. Mission Planning Cycle (typical)

The purpose of a command and control system that probably most often comes to mind is execution. The execution function aims to fulfill the commander's directions efficiently and effectively. Sound execution should follow from a properly organized and technically capable C^2 system. In practice, friction, in the form of both enemy reactions and one's own response to internal and external difficulties, intervenes to disrupt the process. Physical C^2 structures must be robust and flexible to deal with friction. As chapter 5 will show, the USAF probably has the most technically advanced C^2 systems in the world. Of far more consequence for achieving military objectives, however, are doctrinal and organizational foundations.[11] Therefore, this paper will not discuss execution in detail. Ideally, if the air commander's plan has been well thought-out and clearly communicated to his subordinates in a timely manner, execution will be straightforward (although not necessarily easy), and the theater-level air commander will need to monitor mission execution in order to intervene if required.

Finally, an effective C^2 structure should "close the loop" by evaluating the results of the air operation. The assessment function should use relevant measures to determine whether the desired goals are being achieved.[12]

Traditional assessment focuses on individual mission results.[13] The concept is to "poll" the individual targets to evaluate the extent to which they have been neutralized, collate that information, and report to the commander the overall degree of effectiveness against the target system (fig. 4). The evaluation of the effects on the individual target is termed "target assessment" here.[14] For example, during a campaign designed to destroy the enemy's air defense system, planners will identify numerous surface-to-air

missile sites for attack. Following the strikes, the percentage of sites destroyed, neutralized, damaged, and missed is compiled, then combined with similar data on attacks on other target sets, such as enemy airfields, command centers, early warning sites, and communications links, to estimate the overall degradation of the enemy's air defense, which is the operational objective. Because the assessment is based primarily on the results of strikes against individual targets, this is a "micro" or "bottom-up" approach to assessing the effectiveness of the air campaign.

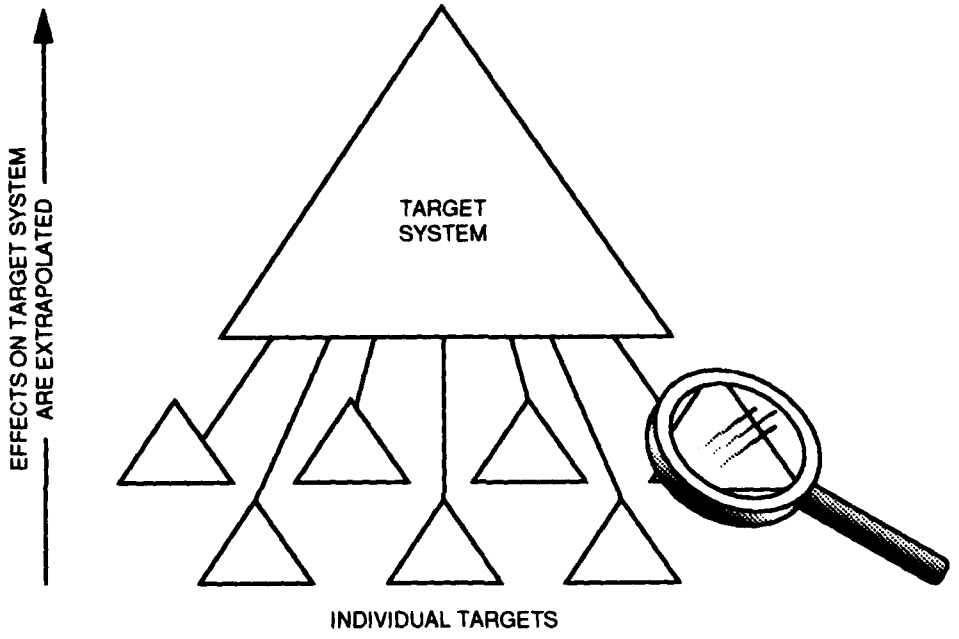

Figure 4. "Bottom-up" Assessment

Clearly, there must also be a method for determining how well attacking the target sets have accomplished the military goals in order to evaluate the translation of military objectives to air force targets. It is critical to understand that exhaustion of the target list equates to achievement of the air power goals *only* if two conditions hold: first, the translation of the objectives into the target list is perfect; second, the targets on the list are neutralized in a short enough time, so that the enemy does not have a chance to accomplish his goals by effectively "working around" the attacks. In other words, the air attack plan flawlessly translated the military objective into a target list, and that list did not change over the period of time necessary to neutralize all the targets. Therefore, an effective assessment must also measure the attack's effect on the enemy's target *systems*—not just on the individual targets, as well as the effects of the degradation of those systems on the enemy's overall capability. The Air Force calls this "mission assessment," which "evaluates the total impact on the enemy's fighting and sustaining capability."[15] Ideally, mission assessment must continually

evaluate the translation of military goals into targets lists, and constantly recommend adjustments to those lists to account for an enemy who constantly tries to negate or mitigate the effects of the attack. However, this can be a difficult prospect in practice. As one commentator has noted,

> Generally speaking, the effectiveness of air power has been more difficult to assess than that of surface forces. Territory seized or successfully defended by an Army can be readily depicted on a map. There are, after all, certain elementary differences between seizing and holding a piece of terrain with land forces and the comparatively fleeting, harder-to-measure consequences, direct and indirect, of air attacks against a target, or set of targets, over time.[16]

The evolution of our present day C^2 structure illustrates the difficulties of translating theoretical requirements into a practical, functioning system. The next chapter will trace the development of tactical air control concepts since Vietnam.

Notes

1. One of the most obvious constraints may be lack of capability. The target may be out of range, or cannot be destroyed or neutralized with existing weapons, or may be too heavily defended. Political constraints can also inhibit plans for attacks against otherwise viable targets. For example, if the political object of the attacks is coercion, the leader of the enemy nation may not be a suitable target if his would-be successors are expected to be even more intransigent. Finally, public support may be an important requirement for a successful military operation. Even if militarily important targets can be legally attacked according to international norms and the Law of War, neutralizing certain categories of these targets negatively influence public opinion. See Lt Col Marc D. Felman, *The Military/Media Clash and the New Principle of War: Media Spin* (Maxwell AFB, Ala.: Air University Press, June 1993).

2. *JFACC (Joint Force Air Component Commander) Primer,* Headquarters USAF/XO, August 1992, 8.

3. The classic work on the dynamic relationship between political and military ends and means is, of course, Carl von Clausewitz's *On War,* ed. and trans. by Michael Howard and Peter Paret (Princeton, N.J.: Princeton University Press, 1976). For a modern discussion of the interrelationships between policy and strategy, see Col Dennis M. Drew and Dr Donald M. Snow, *Making Strategy: An Introduction to National Security Processes and Problems* (Maxwell AFB, Ala.: Air University Press, August 1988). For a case study in development of policy and strategy before the Gulf War, see Bob Woodward, *The Commanders* (New York: Simon & Schuster, 1991), 199–376.

4. Joseph G. Wohl describes a command and control system as "a technological, procedural, and organizational extension of the sensing, processing, and communicating capabilities of the military commanders whose decisions it supports." See his "Force Management Decision Requirements for Air Force Tactical Command and Control," *IEEE Transactions on Systems, Man, and Cybernetics* 11, no. 9 (September 1981): 618.

5. This is a compilation of functions taken from various Air Force publications on the subject. For example, the Air Force's Targeting Handbook for intelligence personnel lists the functions as detection, location, identification, decision, execution, and assessment (AFP 200-18, *Intelligence Target Intelligence Handbook—Unclassified Targeting Principles,* 1 October 1990), 9. The latest theater command and control concept of operations for Air Combat Command names planning, dissemination, execution, and assessment (Air Command Concept of Operations for Theater Battle C^4I, Langley AFB, Va.: Headquarters, Air Combat Command/XPJC, 11 March 1993), 8. However, there is general agreement among the

publications on the subject that the functions listed above, in some form, are necessasry to plan, execute, and evaluate air operations.

6. AFP 200-22, *Targeting Profession and Process,* 12 May 1989, 3.

7. Alfred C. Mierzejewski's discussion of the criticality of coal to Nazi Germany in his book, *The Collapse of the German War Economy, 1944–1945* (Chapel Hill: University of North Carolina Press, 1988). Mierzejewski blames bureaucratic infighting as the reason intelligence and targeting agencies failed to understand the German economy, 180–81.

8. A formal definition of targeting is "the process of selecting targets and matching the proper response to them, taking into account operational requirements and capabilities." While the term *targeting* can be used in its broadest sense to include six phases—Objectives and Guidance, Target Development, Weaponeering Assessment, Force Application Planning, Execution Planning, and Combat Assessment—targeting here means selecting individual aim points and match weapons to achieve a desired outcome. See AFP 200-18, *Intelligence Target Intelligence Handbook—Unclassified Targeting Principles,* 1 October 1990, 8, and AFP 200-17, *An Introduction to Targeting,* 23 June 1989.

9. *JFACC Primer,* 2.

10. For a comprehensive discussion of offensive versus defensive in both air-to-surface and air-to-air operations, see Col John A. Warden III, *The Air Campaign: Planning for Combat* (Washington, D.C.: Pergamon-Brassey's, 1989), chaps. 2–4.

11. France probably had the most technically advanced Army of any nation on the eve of the Second World War. Her tanks and artillery were particularly formidable, and the Dewoitine 520 was arguably the Allies' best fighter in 1940 (although there were far too few of them). However, French doctrine and organization were notably deficient. See Robert A. Doughty, *The Seeds of Disaster: The Development of the French Army Doctrine, 1919–1939* (Hamden, Conn.: Archon Books, 1985), 181–83, and Charles Christienne and Pierre Lissarrague, *A History of French Military Aviation,* trans. Frances Kianka (Washington, D.C.: Smithsonian Institution Press, 1986), 299–303, 329.

12. AFP 200-22, 56.

13. "Poststrike (combat assessment) is the *examination of targets* to determine how effective the damage mechanisms were, to decide how successful the strike or attack was, and to recommend any restrikes, changes in weapons, forces, tactics, or strategies needed." (Emphasis added.) AFP 200-18, 30.

14. Bomb Damage Assessment (now termed Battle Damage Assessment) and Munitions Effects Assessment are combined here as "Target Assessment" (as opposed to Mission Assessment).

15. AFP 200-22, 5.

16. *Gulf War Air Power Survey* (hereafter referred to as *GWAPS), Effects* (U), draft, March 1993, 1–17. (Secret) Information extracted is unclassified.

Chapter 3

Command and Control in Action
How the Tactical Air Control Center Evolved

Initiated by the apparent failure of some of these command control computer systems to satisfy their users, questions about the commander's real needs led to two interesting conclusions. First the requirements which had been levied on the system developers were simply the sum total of everything the commander's staff thought might be nice to have. And second, there was no general analytic or theoretical basis for making judgements about what information was needed by whom, or how quickly and in what detail he needed it.

—Dr Joel Lawson, Jr., 1981
IEEE Control Systems Magazine

The Vietnam conflict was a watershed in the formation of Air Force concepts for the control of forces in regional war. Air operations in the theater were divided both geographically and organizationally, reflecting the divided command structure in Vietnam. This division persists in our contemporary control structures.

Army Gen William Westmoreland, commander, US Military Assistance Command, Vietnam (COMUSMACV), headed all US military operations in South Vietnam. He was therefore responsible for air operations in South Vietnam and exercised control through his air deputy, the commander of the 2d Air Division, later Seventh Air Force. Westmoreland also exercised direct control over air operations in Route Package One (RP1), the bombing tract just north of the demilitarized zone (fig. 5), arguing that enemy activity in that area directly affected his combat operations in the South. To complicate matters, Westmoreland's air deputy did not "own" the heavy bomber force operating in South Vietnam, and later, in North Vietnam. Strategic Air Command (SAC) in Omaha and its subordinate headquarters, Eighth Air Force in Guam, controlled the B-52s, and coordinated with Westmoreland and other agencies through an advanced echelon in Saigon.[1] Air command arrangements for operations over North Vietnam were also complex (fig. 6). The route packages were designed to facilitate coordination between the different services, but ended up dividing command, thereby violating the Air Force tenet of centralized control. The Navy's Task Force 77 was responsible for RPs II, III, IV, and VIB, and reported to 7th Fleet, a subordinate of the commander in chief, Pacific Fleet (CINCPACFLT), who in turn reported to the commander in chief, Pacific (CINCPAC). The Air Force, meanwhile, controlled operations in RPs V and VIA, and reported to Seventh Air Force, a

subordinate of commander in chief, Pacific Air Forces (CINCPACAF), who also worked for CINCPAC. Centralization of all air assets, including SAC bombers, theoretically occurred only at the level of the Joint Chiefs of Staff (JCS), if at all.

While Air Force leaders like Gen William Momyer, the ranking airman in Vietnam from Spring 1966 onward, hoped to increase operational effectiveness by replacing theater-level coordination with theater-level centralization, problems with command arrangements were intractable at the political level.[2] The Vietnam War, in particular, illustrated the difficulties of translating political goals into target lists. President Lyndon Johnson's "Tuesday Lunch Group," whose direct control over target selection is well known and has been widely criticized, reflected a wider problem of fragmented command arrangements.[3] This fragmentation of authority and responsibility effectively eliminated the Air Force's ability to develop a command and control system that would exercise responsive, centralized control over all of the disparate air operations from analysis and planning to execution and assessment. Instead, the Air Force's response was to build a system that would coordinate with maximum efficiency, and perform its tasks under the political and operational constraints of the time. The primary influence on that system was Westmoreland, since he was the commander with the preponderance of assets. Westmoreland's vision of the war in Vietnam emphasized the ground campaign in the South, rather than a coercive air campaign against the North. Thus, Westmoreland's perception caused the Air Force to optimize its C^2 arrangements in South Vietnam for a traditional "tactical role" (i.e., in support of land campaign). The Seventh Air Force Tactical Air Control Center (TACC) at Tan Son Nhut Air Base near Saigon became the primary air command element for the war in South Vietnam. A second TACC, the Seventh Air Force Command Center (7 AFCC), was also established at Tan Son Nhut.[4] Manned exclusively with US personnel, 7 AFCC controlled the air war in Laos and North Vietnam, which was primarily an interdiction campaign with occasional episodes of strategic attack against the North Vietnamese.

Another TACC the 7/13 AF TACC in Thailand—was originally established in 1965 to control strikes in Laos, but later became the alternate 7 AFCC. Its primary function was to monitor missions returning to their bases, "arranging any necessary aerial refueling or search-and-rescue efforts."[5] Earlier in the war, the Air Force had supported the establishment of an overall theater air commander for Southeast Asia, but political difficulties prevented giving the ranking airman in Saigon control of all air assets in Southeast Asia.[6] The Thai authorities would not allow their Air Force to be commanded by an American airman outside Thailand, so the Air Force opted for the easy solution and established a separate command in Bangkok, thus creating another TACC. The result was three separate organizations responsible for planning and executing Air Force air operations in Southeast Asia: 7 TACC for the air war in the South, and 7 AFCC (with its subordinate element in Thailand) for the air war in Laos and the North.[7]

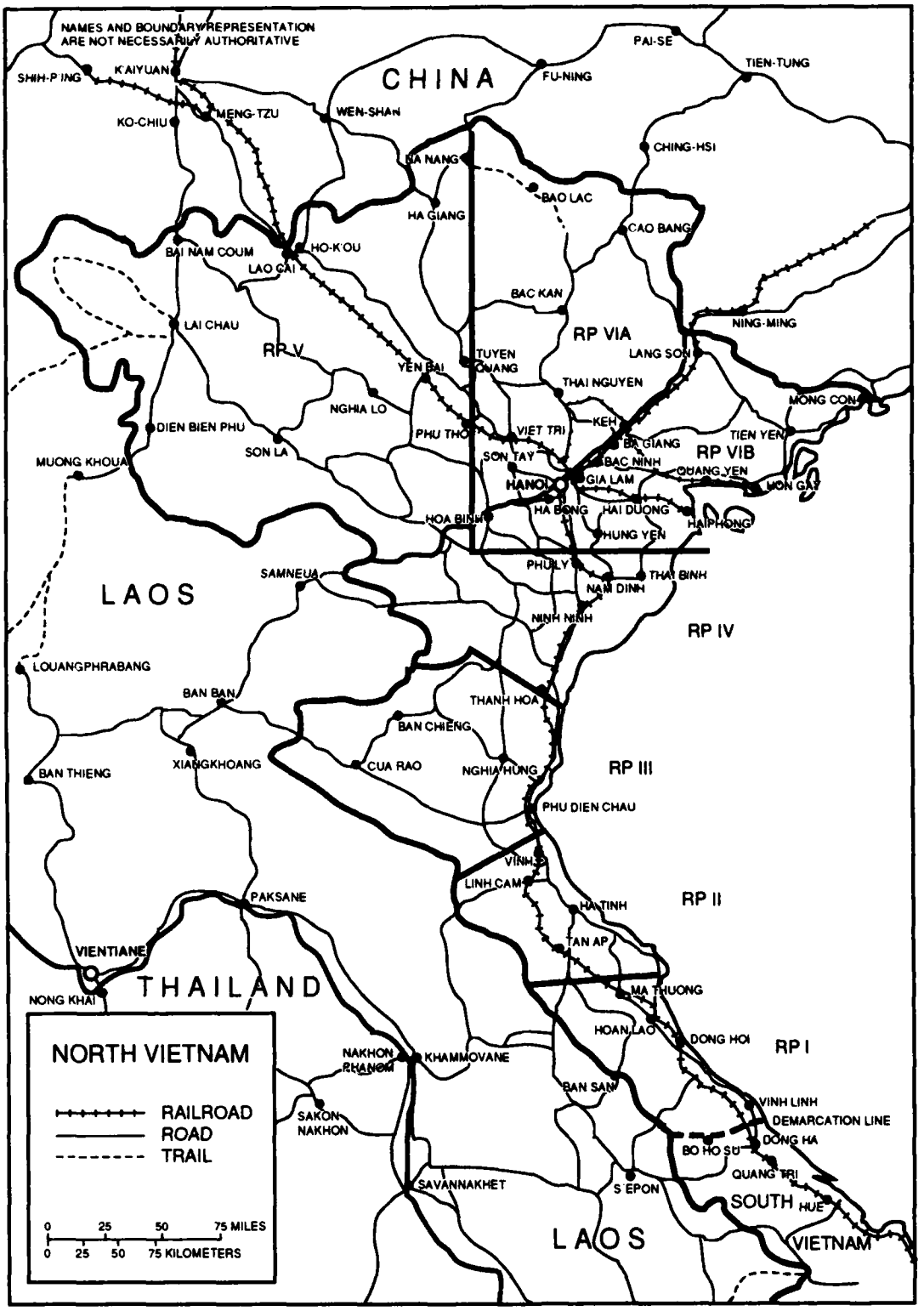

Figure 5. Route Packages in North Vietnam

Source: Lt Col John J. Lane, Jr., *Command and Control and Structures in Southeast Asia*, The Air War in Indochina, vol. 1, Monograph 1 (Maxwell AFB, Ala.: Airpower Research Institute, 1981), 66.

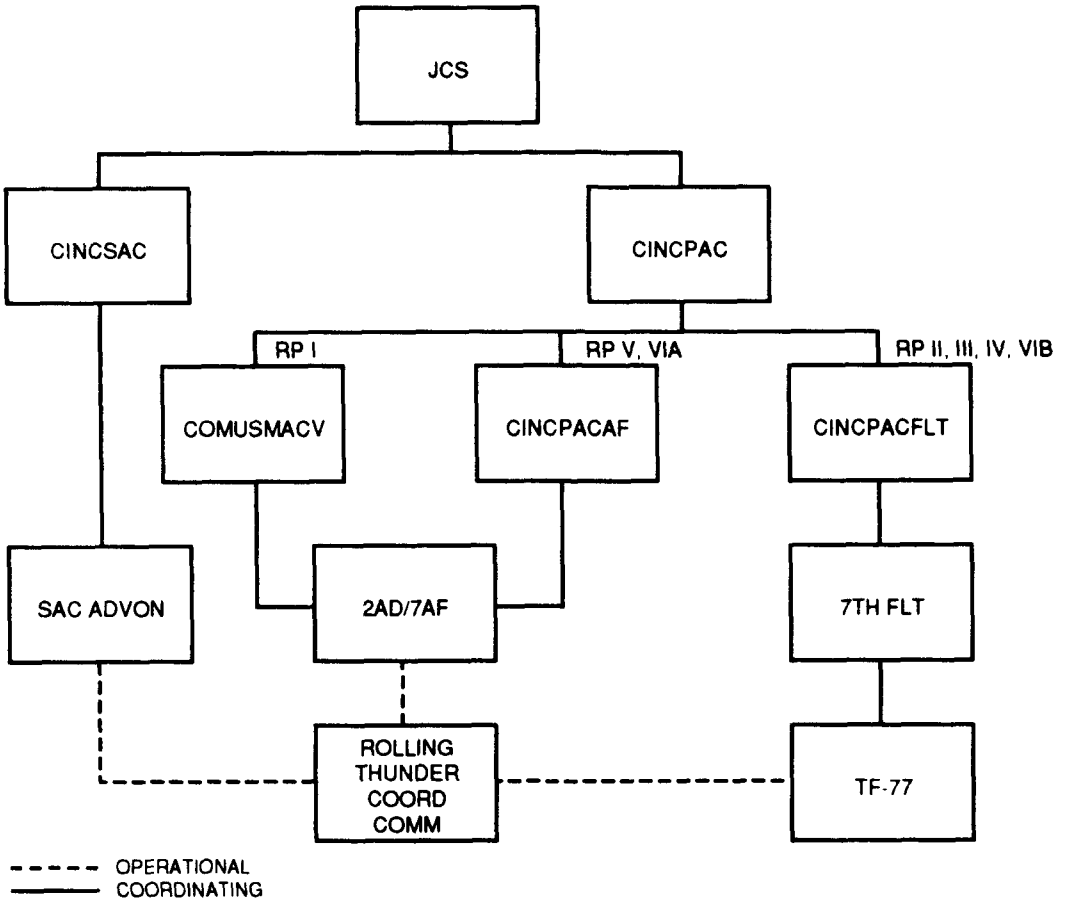

Figure 6. Command Structure for North Vietnam Operations

Source: Lane, *Command and Control,* 68.

As in Korea, the TACC system was initially found to be too slow to react to Army requests for air support in South Vietnam.[8] The Seventh TACC improvements focused on reducing response times for fulfilling Army requests, improving communications and radar coverage, and coordinating various air units. Gradually, the control structures for executing close air support missions became highly responsive, mainly due to the network of Direct Air Support Centers (DASC) (fig. 7) and their subordinate elements assigned to Army corps headquarters.[9] This system made extensive use of ground and airborne forward air controllers for final target identification and positive control over the strike aircraft, not only to direct them to the precise location of the enemy, but also to avoid friendly casualties.[10] Airborne elements of the system, such as C-130 Airborne Battlefield Command Control and Communications aircraft, were developed to help reduce response times against moving targets in the fluid ground battle. The concept of operations was to launch alert aircraft, maintain airborne alert aircraft, or divert lower

priority missions to fulfill immediate needs. Thus, by the height of the war, the C^2 structures in South Vietnam had evolved to facilitate responsive air support to ground commanders.[11]

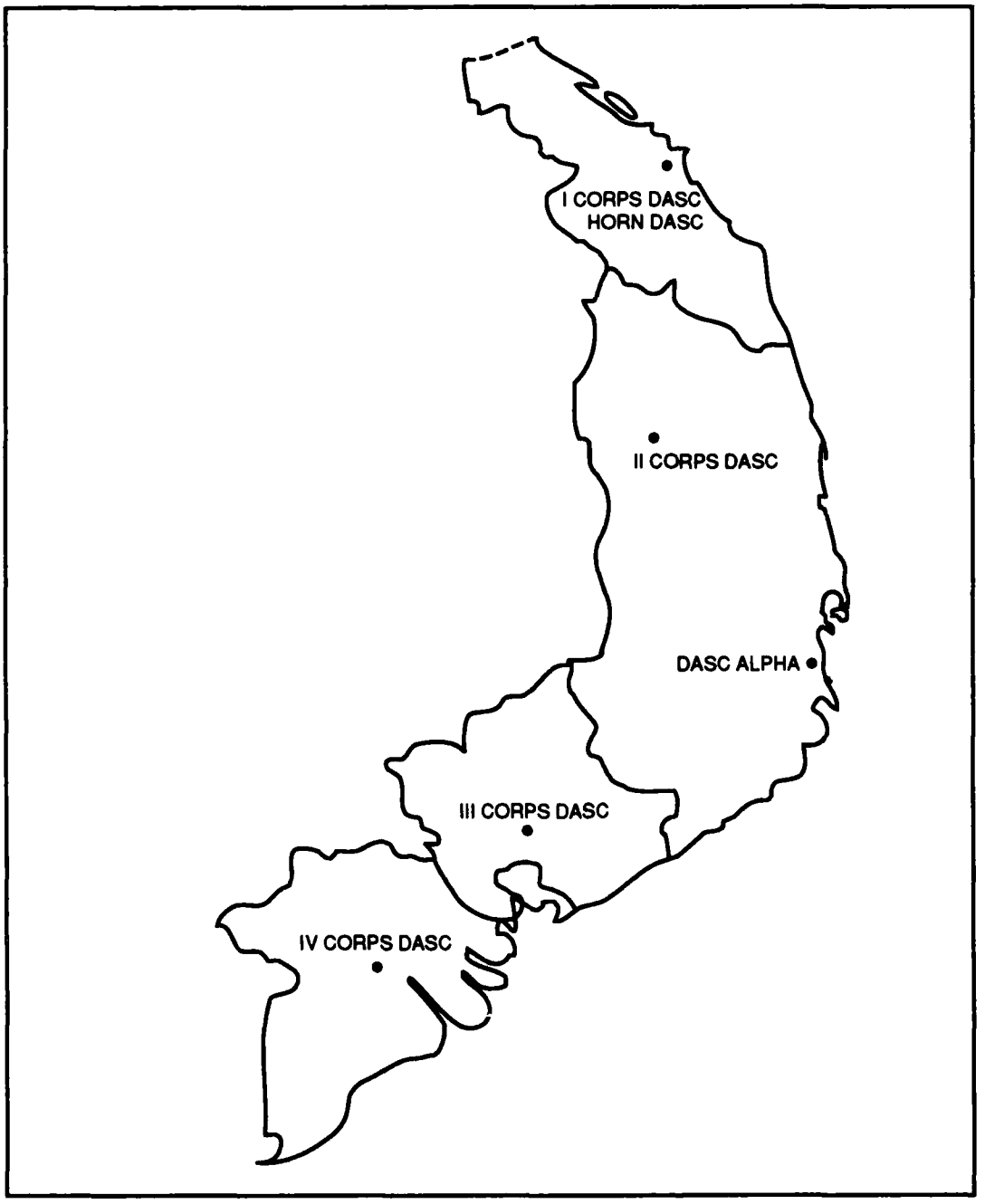

Figure 7. DASCs in South Vietnam

Source: Lane, *Command and Control*, 84.

In contrast to the air war in the South, a highly responsive C^2 system did not develop for targets in the North. First, the lengthy approval process for strategic and tactical interdiction targets during Rolling Thunder meant that the services submitted their target lists several weeks in advance.[12] This delay allowed for extensive and thorough target analysis and mission planning of most targets, excepting the occasional last-minute change. Second, the air war in the North and in Laos was controlled by a different element, the 7 AFCC. This division of this control center into a primary unit in Saigon and a subordinate unit in Thailand "solved" both the political problem (Thai sensitivities) and the organizational problem (the debate over Westmoreland controlling the theater air effort versus centralization at a higher echelon). Control of Air Force operations outside South Vietnam was exercised from these TACCs. Since these operations were almost exclusively preplanned deep interdiction and strategic efforts, responsive planning for air operations was likewise unnecessary. Thus, the control systems for the "tactical" air war in the South, and for the strategic/interdiction campaign in Laos and the North, developed somewhat independently.

The Spring invasion of South Vietnam by the North Vietnamese Army in 1972 prompted a US response, Operation Linebacker. Since this was, in the North, a classic interdiction campaign against a conventional ground force on the move, one might expect that a highly responsive C^2 system evolved during the seven months of the operation. Yet, little additional analysis at the strategic level was accomplished, mainly due to the concept of operations. Linebacker I targets were largely the same ones attacked during Rolling Thunder.[13] For three years during the bombing halt in the North, analysts could observe and study North Vietnam's war- making systems, and catalog target coordinates and photographs at an unhurried pace. Short-notice analysis was largely unnecessary, since the railroad junctions, power plants, road networks, and other deep targets had been so well studied previously.[14] Air power's success in frustrating Hanoi's war aims, even under the fragmented command arrangements reflected by the Route Package system, served as well to obscure the Air Force's inability to responsively target strategic objectives. Although during Linebacker the Seventh Air Force succeeded in modifying its C^2 system for near-real-time targeting in air-to-air combat,[15] air-to-surface war still imposed constraints, requiring substantial time to analyze a strategic target, weaponeer the target, task a sortie, attack the target, and assess the results.

Likewise, Linebacker II missions against strategic targets in the Hanoi-Haiphong area in December 1972 were also preplanned and prescripted in accordance with Strategic Air Command's nuclear war doctrine. The targets were nominated by SAC the previous August, and the final mission planning was accomplished by Eighth Air Force in Guam.[16] These missions against strategic targets were thus the fruit of months of detailed analysis,[17] as opposed to missions in the South, where the Air Force identified and attacked tactical targets according to the needs of the situation.

Tactical targets generally do not make target "systems" in a classical strategic sense. The value of troops, tanks, vehicles, and other fielded forces is mainly dependent on their strength and position in relation to the ground battle lines.[18] Therefore, there is little need, nor is there time, for the detailed analysis required in strategic targeting to determine how the enemy's entire war-making system is structured and identify its key vulnerabilities. Additionally, the land battle is the prime concern of the ground commander. His intelligence staff is highly motivated to determine the location, disposition, strength, and intentions of the enemy ground force, and constantly passes on his priorities for "deep" attacks to the air forces. The result is that responsive command and control is required by the nature of air war in support of land forces, and the system of Direct Air Support Centers, forward air controllers, and airborne C^2 aircraft developed in South Vietnam as a direct result of this need.

The upshot is that the strategic air war in the North was planned and controlled quite differently from the tactical war in the South. There was little incentive to develop *responsive* planning functions for air war in North Vietnam, while there was little need to develop comprehensive intelligence analysis, targeting, or assessment functions for air support of fluid ground operations in South Vietnam. The Army set targeting priorities in South Vietnam. The vast majority of missions flown in the South were in support of ground force requirements.[19] Thus there was little need for the Air Force to develop its own tactical targeting analysis system, since the concept of close air support holds that the ground commander has the final say on the target. Since the Army nominated the targets, the only meaningful measure of effectiveness was the efficiency with which the ground commander's priorities were fulfilled. Likewise in the North, there was only occasional need to react to changes in missions which were preplanned well in advance. Ironically, the assessment requirements were similar to that in the South. Effectiveness was based on the *efficiency* with which the individual targets were neutralized, since the Seventh AF commander did not "call the shots." The targets were chosen by others; either by the president, the JCS, CINCPAC, or COMUSMACV. While it is true much time was devoted in Washington to analyzing the overall air effort, the regional assessment requirements were generally limited to collecting data on the efficiency of individual strikes.[20]

Thus, the "ground side" of the Tactical Air Control Center emerged from Vietnam as a dual system: preplanned (primarily interdiction) targets were handled as part of a 24- to 72-hour tasking cycle. Fixed targets such as bridges, railway yards, truck parks, supply dumps, tunnels, and so forth, were not moving; there was time to do detailed intelligence analysis and properly weaponeer targets to assign the most suitable ordnance and aircraft to accomplish the mission. Deep, heavily defended targets (including deep interdiction and strategic targets) were treated in this fashion. The attacks were mostly planned and assigned well in advance of the strike date, allowing for a division of labor between the planning and execution personnel at the TACC. Those targets that were not had been assigned on the "spur of the

moment" by higher echelons. Yet the Air Force had little stake in the success of these strikes, since they were not part (in the Air Force's view) of any coherent strategy. These targets were chosen by someone else, and received emphasis commensurate to their worth, or lack thereof.

Mobile tactical targets, however, such as convoys and enemy ground forces, either on the move or engaging friendly troops, required rapid response. There was no time, and indeed, no need for the same level of detailed planning. The assigned aircraft would be sent to a general location, or launched from alert status, or diverted from a lower priority mission (there were plenty of these), and sent to a forward controller for final target assignment based on the ground situation. The pilot would receive en route a briefing on the target area air defenses, friendly troop locations, and other pertinent information, and plan his attack in flight, usually while holding over friendly lines in safe airspace. Thus, since the ground forces set the target priorities, the major portion of the TACC's assessment efforts was devoted to determining damage to targets *as an end in itself*. According to the McNamara Pentagon, if information was not quantifiable, it was not considered useful.[21] At the same time, in the Air Force's tactical community, effectiveness became equated with efficiency.

After Vietnam, the Air Force's command and control structures reflected the supposed lessons of Southeast Asia. The USAF maintained air command and control elements that had largely been lost during the post–Korean era.[22] The Air Force retained its Tactical Air Control Wings, forward air controllers, and Direct Air Support Centers, and Air Force liaison officers trained regularly with the Army. The Air Force exercised its fighter forces primarily in air defense and joint army exercises. There was little emphasis on strategic air war.[23] Gone were the days of F-105s training to deliver nuclear bombs on Soviet surface-to-air missile sites. Thus, in the 70s and 80s, conventional war became synonymous with tactical (i.e., in support of an army) operations.

Airmen who fought in Vietnam rose to leadership positions. Their subordinates accepted their leaders' vision of conventional war as tactical war. The TACC became the doctrinally approved air command element of conventional war.[24] Additionally, the Eifel system, a C^2 system designed for use by NATO forces in Europe, was also optimized to fight an air war in support of a land campaign against the Warsaw Pact.[25] NATO's declared strategy of forward defense held that air power would primarily support the ground forces to hold back a conventional Soviet armored invasion of Western Europe.[26]

During the late 70s, there were few changes to the TACC; those were mainly technical. Little was written on the theoretical foundations of command and control of air forces. A 1978 study on the Tactical Air Control System concluded that the TACS needed better equipment and better training.[27] However, since the TACS usually rated lowest priority in budget battles, the recommendations were largely ignored. The Tactical Air Command was in the midst of modernizing its fighter forces and did not allocate money to C^2; the Air Force was increasing procurement of the F-15 and A-10, which had recently become operational, and fielding the F-16 as

well. Finally, by the mid-80s, the TACS was in such disrepair that major changes were urgently needed.[28]

In December 1985 Gen Robert Russ, the TAC commander, initiated "The Year of the TACS."[29] General Russ's specially appointed task force reviewed equipment, manning, and training of the Tactical Air Control System and all of its subordinate elements.[30] Briefly, while technical improvement programs were begun, and immediate organizational and training problems were addressed, the "Year of the TACS" initiatives did not alter the underlying concepts of control of conventional air war that had remained mostly static since Vietnam. Equipment modernization programs initiated such improvements as the Computer Assisted Force Management System for producing and distributing air tasking orders, which aided the efficient operation of the TACC.[31] However, doctrinal foundations remained unquestioned. Studies continued to define characteristics of C^2 systems in such terms as "supportability," "interoperability," "transportability," and "survivability."[32] The need for any fundamental change was unrecognized,[33] and TAC entered the 90s with a vision of its role in conventional war as supporting the land campaign.[34] By this time, the Air Force had signed letters of agreement with the Army, emphasizing its commitment to supporting the Army's "AirLand Battle" doctrine, which envisioned the Air Force in a supporting role for land operations.[35] Figure 8 shows a diagram of the planning concept for tactical air employment in the then-current TACC regulation.

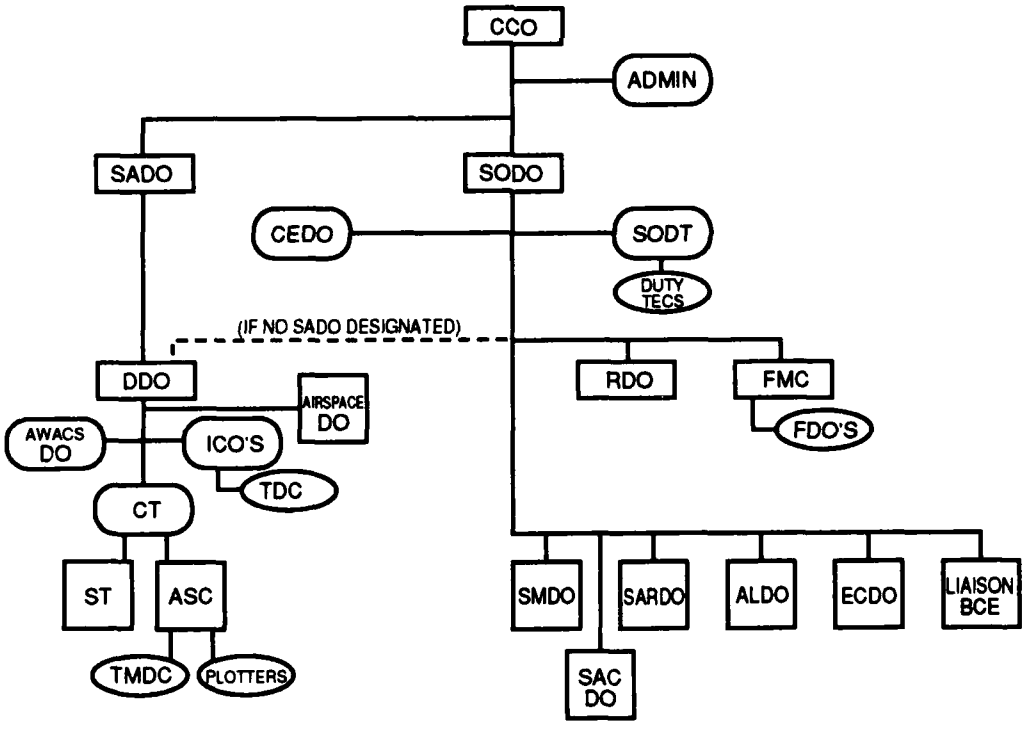

Figure 8. TACC Combat Operations Division

Source: Excerpt from Tactical Air Command Regulation (TACR) 55-45, *Tactical Air Control Center*, 8 April 1988.

Thus, the USAF entered Desert Shield with a conventional war command and control structure based on the TACC, whose fundamental concepts of operation were mostly unchanged since Vietnam. The next chapter will compare those concepts with the "idealized" C^2 structure described in chapter 2.

Notes

1. Robert F. Futrell, *Ideas, Concepts, Doctrine: Basic Thinking in the United States Air Force*, vol. 2 (Maxwell AFB, Ala.: Air University Press, December 1989), 282.

2. See General Momyer's discussion of centralized control in his *Air Power in Three Wars (WWII, Korea, Vietnam)* (Washington, D. C.: Superintendent of Documents, 1978).

3. See Mark Clodfelter, *The Limits of Air Power: The American Bombing of North Vietnam* (New York: Free Press, Macmillan, 1989), 120–25, for a discussion of decision process at the Tuesday Lunch Group, as well as military reactions to Johnson's guidance.

4. Lt Col John J. Lane, Jr., *Command and Control and Structures in Southeast Asia,* The Air War in Indochina, monograph 1 (Maxwell AFB, Ala.: Airpower Research Institute, 1981), 76–77.

5. Ibid., 77.

6. John Schlight, *The War in South Vietnam: The Years of the Offensive, 1965–1968,* The United States Air Force in Southeast Asia (Washington, D.C.: Office of Air Force History, 1988), 71.

7. Actually, there were a total of five separate installations which carried the TACC name. The other two were established to extend communications and radar coverage and were not true TACCs in the doctrinal sense. See Lane, 77–78.

8. John Sbrega, "Southeast Asia," *Case Studies in the Development of Close Air Support*, Benjamin Franklin Cooling, ed. (Washington, D.C.: Office of Air Force History, 1990), 423.

9. Headquarters 2d Air Division (PACAF), *2nd Air Division Historical Reports, Tactical Air Control Center (U),* AHRC K526.07. (Secret) Information extracted is unclassified.

10. Ibid.

11. Schlight, 292–95.

12. Momyer, 99.

13. Clodfelter, 173.

14. Ibid., 159. Most targets required precision ordnance, further increasing the need for detailed intelligence. Most of the materials were available, however, after three years of building target folders.

15. Maj William J. Nichols, *From Teaball to Fastball: The Evolution and Future of Real-Time Intelligence in the Cockpit,* Maxwell AFB, Ala., thesis submitted to the School of Advanced Airpower Studies, May 1992.

16. Maj Cregg Crosby, *8th Air Force History,* vol. 2, quoted in Brig Gen James R. McCarthy and Lt Col George B. Allison, *Linebacker II: A View from the Rock,* ed. Col Robert E. Rayfield, USAF Southeast Asia Monograph Series, vol. 6, Monograph 8 (Maxwell AFB, Ala.: Airpower Research Institute, 1979), 26–27.

17. Ibid. The original target list was received by Eighth Air Force on "10 or 12 August" 1972. The planner estimated 90–95 percent of the actual Linebacker II targets were on the original list.

18. Surprisingly, directives shed little light on how to determine the value of enemy ground force targets. AFP 200-18 advocates first priority for the "most threatening" formations. presumably the strongest units nearest the battle line. The section on targeting in TACR 55-45 indicates targeting formations which pose "the greatest threat" to friendly forces. AFP 200-18, vol. 1, 72, and TACR 55-45, 7-4.

19. Sbrega, 449.

20. An example of the type of information the highest commanders considered important, see Adm U. S. G. Sharp, *Report on the War in Vietnam (as of 30 June 1968)* (Washington, D.C.:

US Government Printing Office, 1969). In his "North Vietnam Target Element Summary" tables, he lists numbers of targets in various categories—"Destroyed," "Damaged," and "Total Destroyed and Damaged." While these figures are precise, their significance in terms of achievement of the military goals is not explained.

21. David Halberstam recounts a story, apparently told to him by Jack Raymond of the *New York Times*, of the defense secretary's visit to Da Nang in 1965, which typified McNamara's obsession with quantifiable data: while a Marine colonel briefed him on the local situation, the secretary interrupted and "spouted his own version, all in numbers and statistics." The colonel, who was very bright, read him immediately like a man breaking a code, and without changing stride, went on with the briefing, simply switching his terms, quantifying everything, giving everything in numbers and percentages, "so blatant a performance that it was like a satire." Raymond "began to laugh and had to leave the tent." Later McNamara commented that the colonel was "one of the finest officers I've ever met." David Halberstam, *The Best and the Brightest* (New York: Random House, 1972), 249.

22. For example, the 25th Tactical Air Support Squadron, a forward air control unit flying O-2A Cessna Skymasters, was assigned to Eielson AFB, Alaska, in 1974. In fact, the entire Tactical Air Control System, from Direct Air Support Centers to air liaison elements, became a large "holding tank" for fighter pilots during the drawdown after the Vietnam War. (author)

23. AFM 1-1, *United States Air Force Basic Doctrine,* 15 January 1975, describing the mission of "Strategic Attack," adds the following afterthought: "these (strategic) aerospace forces maintain a capability to use either conventional or nuclear weapons." (3-2) The following version, published in 1979, divides air operations into "Theater," which are either conventional or nuclear, and "Strategic," which are not so categorized. AFM 1-1, *Functions and Basic Doctrine of the United States Air Force,* 14 February 1979, 1-10, 1-11.

24. TACM 2-1, *Aerospace Operational Doctrine: Tactical Air Operations,* 15 April 1978.

25. Eifel was developed to provide a common network for disseminating air tasking information among various elements throughout various countries in Europe. (author)

26. Sir Michael Knight, "Air Power in the NATO Alliance," in *War in the Third Dimension,* ed. R. A. Mason (London: Brassey's, 1986), 81–82.

27. *TACS Special Study Final Report (U),* 7-30 August 1978, ACC Historical Office, Langley AFB, Va., no. 913, Safe 27, File YOT. (Secret) Information extracted is unclassified.

28. Action Memorandum 85-134 from Brig Gen Harold G. Hermes, Headquarters TAC/COS, to Lt Col Lloyd McGrady, ACC Historical Office File YOT-1(5), Langley AFB, Va., 16 December 1985.

29. Memorandum from Lt Col Lloyd McGrady to staff, 21 February 1986, ACC Historical Office File YOT-1(5), Langley AFB, Va.

30. Maj Gen John Conaway, chief of the Air National Guard, to Gen Robert Russ, commander, Tactical Air Command, letter, dated 22 December 1986, ACC Historical Office File YOT-1(5), Langley AFB, Va.

31. The recommendations of the working group which reviewed "readiness, sustainability, force structure, and modernization" were briefed on 26 April 1986 to General Russ. See *TACS Quarterly, Special Edition—Year of the TACS*, (Jan 87?), Langley AFB, Va. Headquarters Tactical Air Command/DOY, 5, 15.

32. *21st Century Tactical Command and Control Study (TC2-21),* vol. 1, Headquarters Air Force Systems Command/XRX, SAIC-85/1733, Science Applications International Corp., August 1985, II-6.

33. Ibid., II-11. The authors recognized Force Planning as a specific operational task, and subdivided it into Assess/Reassess, Plan, Task/Direct, and Control/Monitor. However, this is simply a listing of operational functions. See also *Tactical Air Control System (TACS) 1986 (U),* Headquarters Tactical Air Command/XPJSG, 21 April 1986. (Secret) Information extracted is unclassified.

34. "One of the critical reasons for establishing a (Joint Force Air Component Commander) is to have a central authority and facility to execute the joint air campaign and respond in near real-time *to the fluid battlefield.*" (Emphasis added.) TACP 2-2, 9.

35. "Memorandum of agreement on US Army—US Air Force Joint Force Development Process, 22 May 1984," in *The United States Air Force: Basic Documents on Roles and Missions,*

ed. Richard I. Wolf (Washington, D.C.: Office of Air Force History, 1987), 415. Briefly, AirLand Battle was the Army's vision of war against the Warsaw Pact. Ground commanders would attempt to influence enemy formations far in advance of actual contact, in order to attrit them prior to engagement. The means for influencing the so-called deep battle would be air power. Although the Air Force emphasized that AirLand Battle was Army—rather than Air Force—doctrine, the memorandum reflected the reality that the supreme commander in Europe was an American Army general.

Chapter 4

How the Duality of the TACC Caused Functional Rigidity

After two weeks of war, my instincts and experience told me that we'd bombed our strategic targets enough to accomplish our campaign objectives. But our [battle damage assessment] experts disagreed. They'd say things like, "You failed to destroy the power plant in Baghdad"; yet we knew that in Baghdad, the lights were out.

—Gen H. Norman Schwarzkopf
It Doesn't Take a Hero

On the eve of the Persian Gulf War, Tactical Air Command's concept for planning and directing air operations centered around the TACC's two main operations divisions: Combat Plans and Combat Operations.[1] This divided structure, mirroring the dual requirements of the air war in Vietnam, resulted in the inability to strike targets of opportunity without incurring unknown, but possibly heavy, costs.

The Combat Plans Division was responsible for "tomorrow's" war. Because of the dual nature of the ground side of the TACC, Combat Plans was responsible for detailed targeting and weaponeering of interdiction (including strategic) targets, but not for air support missions on the friendly side of the Fire Support Coordination Line, a geographical limit denoting where air attacks must be coordinated with the movement of friendly troops. To handle the problem of close air support, Combat Plans would anticipate a notional number of ground support sorties based on the guidance of the theater commander, but did not plan to assign specific targets, since tactical targets generally move and may not be positively located until engaged by friendly troops. Ground support sorties would receive specific target assignments once airborne. The Air Tasking Order would normally direct units to provide aircraft on ground alert or airborne alert in anticipation of receiving specific target information some time closer the actual moment of ordnance on target. Sorties diverted from other preplanned missions would, in emergencies, increase support for the ground force.

In contrast, the Combat Operations Division was responsible for executing "today's war." Combat Operations would take over monitoring and controlling a mission beginning about 12 hours prior to launch, because, by this time, details of the planned mission would pass to the unit executing it. Once inside that unit's mission planning cycle time, the mission scheduled against that target would be constrained—changes would likely either delay the mission or reduce planning time available, lowering the probability of success. This is

because operational wings need a finite period of time to plan, in order to maximize their advantages over the enemy, particularly against a fixed, heavily defended target. The planning time can vary with the difficulty and objective of the mission and type of aircraft, but planners generally attempt to have tasking and coordination information to the affected unit 12 to 6 hours prior to takeoff.

But in real war, reconnaissance is ongoing. New possible targets are constantly being located and identified. A target can suddenly become valuable, often because of its relationship to the battlefield. For example, a bridge in the enemy's rear areas has a fixed location and may be struck at the air commander's leisure, depending on his objectives and timetable. But if a large enemy ground unit is en route to the bridge, and by crossing will soon influence the ground battle the bridge suddenly becomes a time-sensitive target.

Strategic targets change value with time as well, not necessarily because of their relationship to the ground battle, but because of the nature of strategic air warfare.[2] Every nation's war-making system is unique. As Alfred Mierzejewski wrote of the Allies' strategic bombing effort in Europe during World War II, "The inability to comprehend how the relative importance of target systems changed over time was the greatest failing of Allied intelligence after its fundamental misappreciation of the German industrial effort."[3] Strategic targets change value over time for a variety of reasons: the enemy is constantly trying to foil the air commander's plan by devising work-arounds, thus changing the structure of his war-making system; battlefield successes and failures influence the importance of different supporting complexes, shifting the enemy's logistics vulnerabilities; political and military objectives can change during the course of a war, further requiring modification of target lists; and strategy is often phased—the commander makes a conscience decision to emphasize different targets at different times in the campaign. For example, an enemy's air defense sector control center may be an extremely lucrative target when the immediate objective is to gain air superiority. But once that superiority has been won, the value of the center as a target substantially drops. The center has not moved, so its value is related to its function, rather than its proximity to the battle lines. Similarly, a supply depot may become less valuable as a target if the supplies have all been consumed.

The director of Combat Operations, usually the officer to whom the air commander delegates his authority for diverting missions, normally has little problem diverting a ground force support sortie to time-sensitive tactical targets.[4] Aircraft assigned this mission usually have a compatible ordnance load, and the crews are generally prepared to attack the types of targets they are likely to encounter (tanks, troops, artillery, etc.). Moreover, the essence of air support to engaged troops is the ability to quickly shift air power from one location to another. The purpose of real-time control elements, such as forward air controllers, is to do just that. The sortie has already been tasked—the question becomes finding a target for it.

The air commander executing a strategic or interdiction campaign has a different problem. He will almost always have more targets than sorties to

neutralize them. If a new target is suddenly identified and located, there are few unassigned sorties he can send to attack it. So in order to neutralize a new "deep" target that might become visible after the unit has received the air tasking order, but before it had executed the strike, the commander faces a dilemma: on one hand, he can add the target to a list of aim points to be attacked later. This has advantages in that the mission can be well planned and optimized for the target and its defenses. But this method is unresponsive. If the new target is fleeting, or time sensitive, its value might decrease (or even disappear) by the time it is eventually struck. On the other hand, he can change a mission's previous target to the new one, if the aircraft has ordnance capable of neutralizing the new target and can suppress the defenses surrounding it. In this case, the air commander is deliberately foregoing the opportunity to strike the originally planned target, which had been placed on the list because of its presumed value to the war effort.

Therefore, there is no practical way for handling heavily defended targets requiring extensive planning, which become apparent between the beginning of the planning cycle and the completion of execution. The air commander cannot force the cycle time to work faster without sacrificing quality of mission planning, nor can he send a "shallow" sortie to strike a "deep" target.[5] A mission assigned to ground support does not normally have the specific ordnance needed to attack a specialized target deep in the enemy's rear area, nor has the pilot received a detailed briefing on the target characteristics or surrounding defenses. Usually a controller would rather divert a deep sortie to a tactical support mission than to send a mission which was originally tasked for close air support deep.[6]

Ordinarily, the decision whether to divert a sortie from striking a previously designated target in order to neutralize a newly visible one is based on balancing the air commander's guidance and priorities against costs. But there is not now in existence any system for assisting the commander to assess those costs accurately, since there is presently no way to determine quickly the relative importance of specific targets, other than the commander's intuition. Although one could argue one "knows" the value of the foregone target (because it was analyzed extensively), that value may change with time if the commander defers attacking it. Its new priority could be vastly different from its previous one. Now, one may have a general idea of the value of the new target based on intelligence's analyses of the value of similar targets or the same types of targets. But this is far more likely to be true in the case of tactical targets (one tank is like another) than in strategic targets, where the *relation* of the target to other elements of the enemy's war-making system is much more important—and complex—than the individual target itself. Even if one could assess the relative value of both targets at some time in the future, this analysis would still fail to account for the cost of disruption to the commander's war plan and the self-induced friction to friendly operations resulting from communicating, coordinating, and reacting to the changes. Such valuations fail to address the effect of last minute changes on aircrews, such as probability of decreased effectiveness against the new target and decreased survivability in a hastily planned mission.

Therefore, in general, one would suspect that the perceived benefits of attacking a strategic target of opportunity would obscure the substantial and real costs of abandoning the commander's original plan. But there is an even more serious flaw in the foundations of the TACC. The problem is the way the TACC assists the air commander to assess his results.

The evolution of the TACC obscured the purpose of assessment, in that the *efficiency* of target servicing became an end in itself. Because the political ends of the Vietnam War were ultimately disconnected from the air targets chosen, measures of effectiveness were based on quantifiable, though not necessarily relevant, criteria. The "body count" is an Army example of a measure of efficiency masquerading as a measure of effectiveness. The Air Force had its equivalent—the sortie count. Sortie counts and sortie rates can tell one about the efficiency of an air force, but nothing about the effectiveness.[7] Unless those sorties score with the right ordnance on the right targets at the right time, they are ineffective. In fact, they are less than militarily useless—they are counterproductive, since they are wasting scarce resources. Likewise, target assessment is a measure of efficiency. It can be used as *evidence* for a measure of effectiveness, but in itself only tells the extent the individual target has been neutralized.

The USAF has traditionally focused on target assessment because it is *possible*. For example, intelligence can, with some effort, measure how many trucks and locomotives aircraft have destroyed in an interdiction campaign. It is more difficult, however, to measure directly the flow of troops and materiel into the combat area, *which is what the count of trucks and trains attempts to measure.* Rather than framing requirements for systems which could measure effectiveness directly, the Air Force focused on the unambiguous, technical-quantitative solution: more capability to observe, report, and transmit effects of strikes on individual targets.[8] In other words, the Air Force asked for more data gathering and faster handling, rather than *better information.* The focus was on quantity and speed, rather than quality. Why is this a problem?

"Bottom-up" assessment carries with it the implicit assumption that the *exhaustion of the target list automatically results in the accomplishment of the military objectives.* Unfortunately, without some way of directly measuring progress toward the commander's goals, we are condemned to remain stuck in the "target assessment loop" (fig. 9).

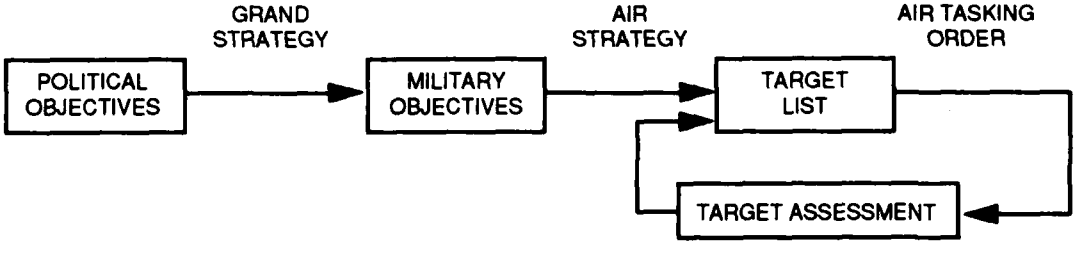

Figure 9. Target Assessment

An example is the Korean interdiction campaign from July 1951 to Spring 1952. During this time, interdiction targets in North Korea were persistently destroyed. However, we still failed to achieve our ultimate objective of persuading the Communists to sign the Armistice. The interdiction campaign was ineffective militarily for a number of reasons. However, target assessment alone would have mistakenly given the impression that the operation was "working" (because the targets were being destroyed), when in reality, the campaign's objectives had not been achieved.[9]

No doubt, target assessment is still an important component for assessing the extent to which the commander's military objectives are being accomplished. If, for example, one of the theater commander's objectives is the destruction of enemy aircraft for reasons, say, of postwar regional stability, counting destroyed aircraft is a completely appropriate measure of effectiveness. Additionally, aircrews need target results for mission planning and threat avoidance. But to the air commander, individual target results are only valuable in themselves to the extent that their destruction is connected to the overall *effectiveness* of the campaign.

In summary, tactical doctrine, based on experience in Vietnam, made it impossible for the deep interdiction and strategic targeting function to perform optimally with less than 24 to 72 hours of planning time. Fluid battlefield support would be handled dynamically by air elements collocated with the Army. The concept succeeded because the mission planning requirements for tactical targets are generally lower than for strategic targets. Additionally, the Air Force concept of target assessment, as an end in itself, disconnected the target set from the political and military goals. Air commanders might translate objectives into target sets, but evaluation of effectiveness would be based primarily on how efficiently the set was attacked. The formal command and control structure did not provide a mechanism for validation of the set itself.[10]

Preliminary studies of Operation Desert Storm infer that many of these problems remain embedded in today's conventional command and control system. While a detailed analysis of C^2 in the Gulf War is beyond the scope of this paper, reports and articles on Command and Control in Desert Storm, as well as writings by personnel involved in planning and executing the war, tend to support the conclusions set forth here.[11] Already the Air Force is implementing improvements to its ability to command and control regional war. The keystone of this capability will be the new Air Operations Center. Whether the USAF has truly adapted its C^2 system to fight conventional strategic air war is the topic of the next chapter.

Notes

1. In addition, the TACC had two intelligence divisions that mirrored the "today's war" and "tomorrow's war" structure of Combat Operations and Combat Plans. These were the Enemy Situation and Correlation Division and the Combat Intelligence Division.

2. AFR 200-18, vol. 1, *Target Intelligence Handbook: Unclassified Targeting Principles,* 1 October 1990, 14.

3. Alfred C. Mierzejewski, *The Collapse of the German War Economy, 1944–1945* (Chapel Hill: University of North Carolina Press, 1988), 181.

4. In Desert Storm, this function was performed by the leader of the Airborne Command Element (ACE), who performed this duty in an EC-135 command and control aircraft.

5. Lt Col M. Williams, 9 COS, Shaw AFB, S.C., telephone interview with the author, March 1993.

6. Ibid.

7. Even so, sortie counts in themselves are not direct measures of efficiency. For example, one uses 16 sorties to carry 32 500-lb bombs when four sorties could do the job.

8. *21st Century Tactical Command and Control Study (TC2-21),* vol. 1 (U), Headquarters Air Force Systems Command/XRX, SAIC-85/1733, Science Applications International Corp., 30 August 1985.

9. Col R. L. Randolf and Lt Col B. I. Mayo, "The Application of FEAF Effort in Korea, 1952," staff study, AFHC K720.1, 12 April 1952, 1–14.

10. While intelligence manuals recognized the importance of mission assessment and stressed the need to plan assessment at the outset of an air campaign, the *structure* of the TACC didn't recognize that the target set itself would necessarily be an imperfect translation of political and military objectives.

11. See *Gulf War Air Power Survey (GWAPS) Summary,* April 1993. See also Lt Col Richard B. Lewis, USAF, *Desert Storm—JFACC Problems Associated With Battlefield Preparation,* Individual Study Project, US Army War College, Carlisle Barracks, Pa., 15 April 1993; and "Air Tasking Order (ATO) Planning Process for Desert Storm," Briefing Notes, 2 July 1991. See also Comdr Daniel J. Muir, "Desert Storm: A View from the Black Hole," US Naval Institute *Proceedings,* October 1991, 85–86.

Chapter 5

Post-Desert Storm
The Air Operations Center

AOC—Air Operations Center. This is the wartime facility for the Joint Task Force's Air Force Component Commander (AFCC), the unified CINC's Air Component Commander, or the Joint Force Air Component Commander (JFACC). For the old TACS heads, remember AOC is much easier to say than "TACC."

—Battle Management Systems Quarterly

Preliminary studies of the Persian Gulf War indicate that many of the theoretical difficulties of command and control occurred during Operation Desert Storm. The number of sorties flown was so massive that intense friction, much of it self-induced, was generated when commanders attempted to react to targets of opportunity. Coalition air forces relied heavily on the Computer Aided Force Management System (CAFMS), the automated system for writing and disseminating the Air Tasking Order. The sortie load was so heavy, the *Gulf War Air Power Survey* noted, "[i]f [CAFMS] was disabled or shut down for even a short period of time—a few hours—it would have been impossible for the ATO to be distributed throughout the theater within an acceptable period of time."[1] The interaction of this huge sortie rate with a planning system designed for long lead times, and assessment which was efficiency-based rather than effectiveness-based, produced difficulties. As the *Gulf War Air Power Survey* noted,

> If the prime purpose of the air campaign was to attack the Iraqi ability to understand what was happening to them and to defend [from an attack], then attention to absolute physical destruction of targets—as the intelligence community recommended and the [targeting cell] planners rejected—was unnecessary.[2]

Gen H. Norman Schwarzkopf, commander of the Coalition forces, was so frustrated with the disconnection of Battle Damage Assessments from actual operational effects that he implemented a system for forwarding his own mission assessments to his superiors.[3] The intelligence divisions of the TACC, after long years of continued Air Force emphasis on efficiency-based assessments, found that attack planners, who wanted effects-based assessments, did not consider their contributions particularly useful. Yet, these same planners were constantly adjusting the attack plan in response to recent intelligence, frustrating the intelligence organizations who were trying to keep track of the campaign. The survey further noted,

> After the start of the war, [Brigadier General Buster] Glossen and [attack planner Lt Col David] Deptula argued, it was important to keep the Iraqi military confused and disorganized by a relentless, constant attack. Yet, if functional degradation was of overriding importance, then it was not necessary to have so many last minute target and timing changes. The new target could easily have been added to the third day of the planning cycle.[4]

Perhaps. But how does one really know if an attack can be delayed without understanding the expected change of value of the target over time? Indeed, problems of opportunity targeting and assessment were "built in" to the C^2 framework. Much activity in the Department of Defense, particularly in the various intelligence agencies, is currently devoted to learning the lessons of that war.[5] The real question is whether changes resulting from the experience in Desert Storm will be institutionalized.

Following the Persian Gulf War, Tactical Air Command and Strategic Air Command merged, partly due to the growing recognition that the lines between "strategic" and "tactical" air forces had blurred. For example, B-52 heavy bombers had struck Iraqi troop positions while F-15E multirole fighters had attacked Scud missile launching and production facilities.[6] The result of the merger, dubbed Air Combat Command (ACC), will provide the forces and their supporting control structures to the air commander in regional conventional war.[7] In 1991, TAC changed the name of the Tactical Air Control System to the "Theater Air Control System," and renamed the TACC the "Air Operations Center," anticipating the upcoming merger.[8]

The new Air Combat Command also revised TAC's operational doctrine. ACC Manual 2-1, *Operational Doctrine*, adds "Strategic Attack" to the traditional tactical missions of Counterair, Interdiction, and Close Air Support.[9] Additionally, the command issued a new "Concept of Operations for Theater C^4I" (Command, Control, Communications, Computers and Intelligence), and is developing an operating regulation for the new Air Operations Center.[10]

But the AOC looks like a TACC with a different name. While introducing the term to TACS personnel in January 1992, Brig Gen Michael Short, Air Combat Command deputy director for Operations, emphasized the name change and the new organizational shoulder patch, but did not describe any change of mission or function from the older "tactical" organizations to the Theater Air Control System and Air Operations Center.[11] In addition, only two paragraphs of ACC's new operational doctrine are devoted to explaining and developing the concept of strategic attack, as opposed to about six full pages for counterair, four and one-half pages for air interdiction and two pages for close air support.[12] There is no recognition that an independent air campaign might require a different command and control doctrine than a campaign fought primarily in support of land forces.[13] The structure of four main divisions of the TACC (Combat Plans, Combat Operations, Combat Intelligence, Enemy Situation and Correlation) remains, and the process for planning and executing air operations, though improved, remains conceptually similar. Because of the Air Force's commitment to tight centralized control, incompatibility between mission planning time and

response time remains. The potential for friction and high costs associated with diverting combat sorties persist. The fundamental concept of assessment through bottom-up collating of target data also remains.[14] Battle Damage Assessment is still primarily focused on gathering individual target results.

"Target System Assessment" is the official Defense Intelligence Agency (DIA) term for assessment of the effectiveness of strikes on the operation of the targeted system.[15] Not only has this concept been relegated to the status of a subcategory of Combat Assessment under Battle Damage Assessment (fig. 10), but Target System Assessment focuses on the individual target's effect on its parent system, not the value of the system itself, or the relation of the various systems to the commander's accomplishment of his military objectives.[16] There seems to be little recognition in DIA of the importance of mission assessment as a broader concept than just a subcategory of battle damage assessment. Assessment data for individual targets must still travel to the top for decision on restrike, then back down for tasking. There is only limited capability for providing mission-level assessment aids to commanders.[17]

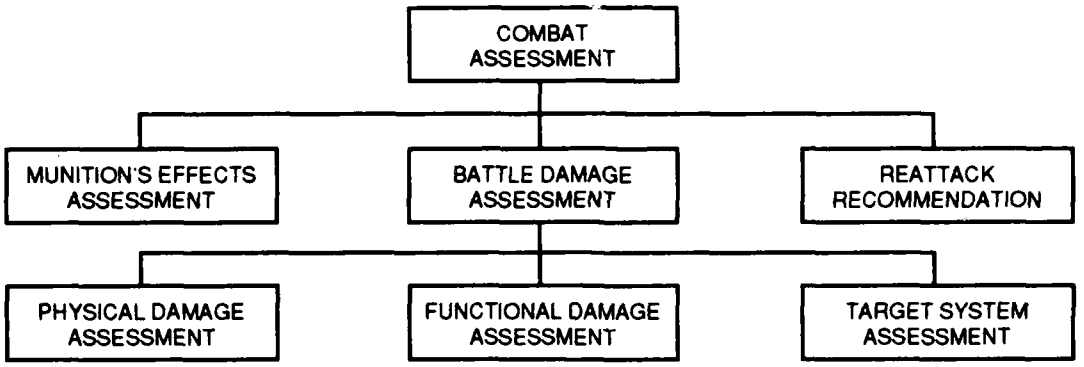

Figure 10. Combat Assessment

There are some encouraging trends. Intelligence support to air operations has undergone a major overhaul, partly in response to deficiencies recognized in the Gulf War. The air intelligence community performed a "Strategies to Tasks," top-down reassessment of the entire intelligence function in the Air Force. Intelligence requirements teams conducted a comprehensive survey of Desert Storm intelligence users, in both operations and intelligence fields, to identify and correct problems.[18] Unfortunately, there still seems to be no recognition for the need to continually revalidate the translation of military objectives into air strategy during a dynamic air war. Rather, ACC is again attempting to use primarily technical improvements to cope with conventional war requirements of the future.

The Contingency Tactical Air Control and Planning System (CTAPS) began development under General Russ as a "Year of the TACS" initiative.[19] The purpose of CTAPS is to link together the disparate elements of the Theater Air Control System and sister-service C^2 systems in order to share the information required by the various users (fig. 11).[20]

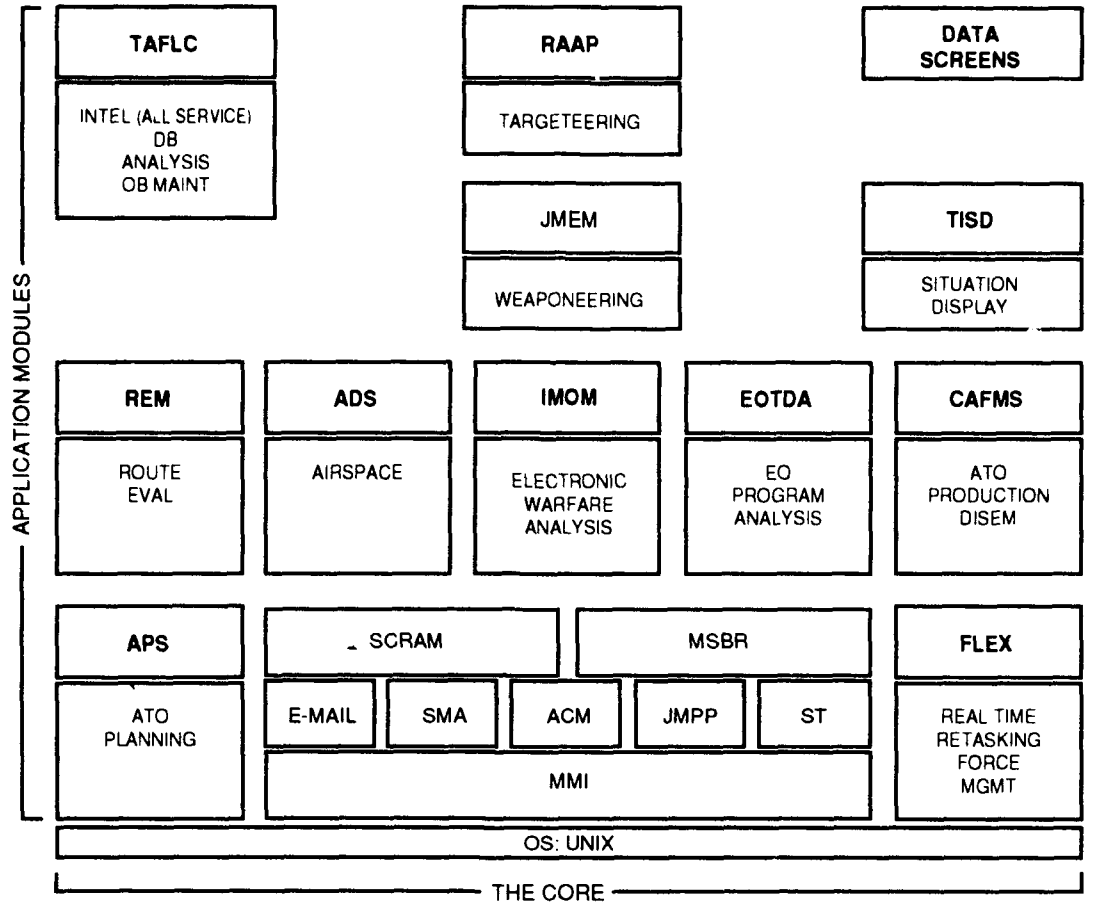

Figure 11. CTAPS Architecture: Mission Application Modules

Source: Briefing Notes, *Contingency TACS Automated Planning System (CTAPS)*, Science Applications International Corp., (undated). Information current as of 17 December 1992.

The concept is for huge relational data bases to store information: CTAPS will transmit and distribute the information to various users. For example, planners desiring details of a potential target will access the data base to extract details such as target location, dimensions, and construction. Weaponeers would access the information in order to choose the most effective ordnance. Aircrews could extract information about threats such as missile defenses surrounding the target. Following an air strike, information regarding the results of the strike would go back into the data base. Thus, each user from the bomb loader to the air component commander could enter and retrieve information tailored to his own needs and responsibilities (fig. 12).

Although CTAPS will offer much needed improvements by speeding the flow of information to those who need it, these are improvements to the *implementation* of air force command and control, not to the fundamental concept. CTAPS will not change the limitations to opportunity targeting

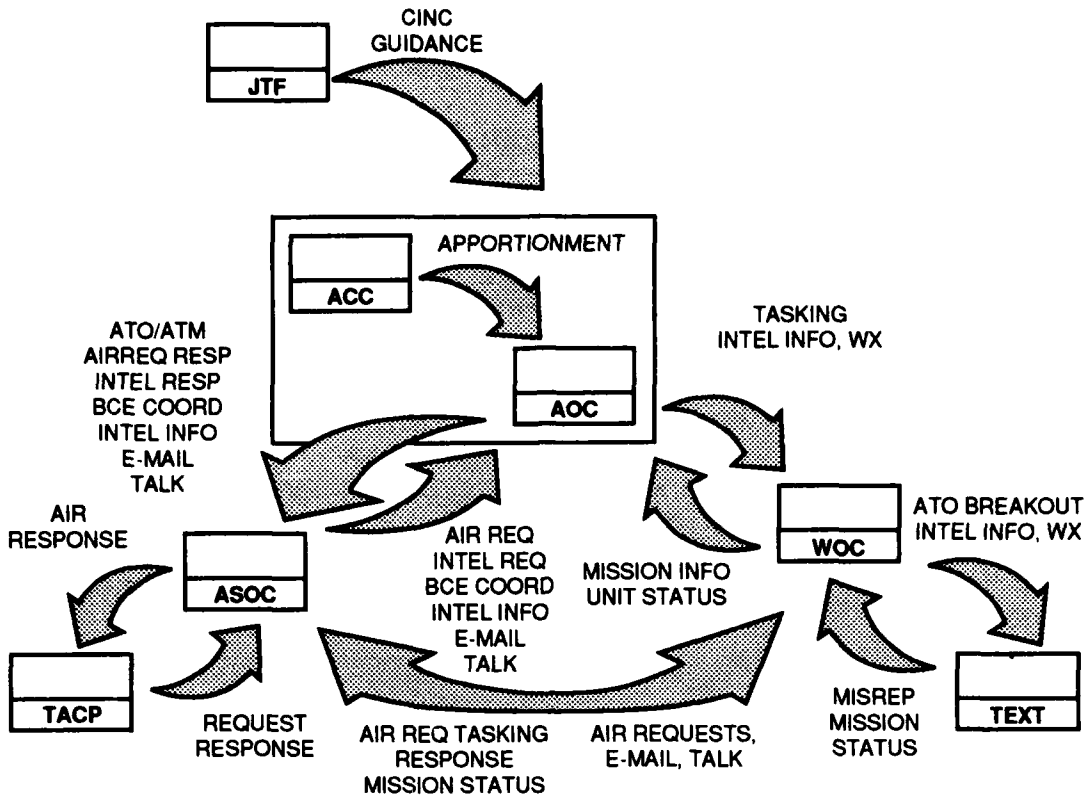

Figure 12. TACS High Level Data Flow

Source: Briefing Notes, *CTAPS*. Information current as of 17 December 1992.

inherent in ACC's C^2 construct, nor will it change the reliance on bottom-up assessment. Not surprisingly, in structuring CTAPS, TAC specified requirements such as "survivability," "capacity," and "flexibility." For example, the developers are concerned with sufficient capacity for storing and communicating data, and whether the system will be interoperable with C^2 equipment of other services. So while these are important considerations, the foundations upon which ACC's approach to command and control rests have been ignored.

In order to adapt to future requirements, the ACC should design its command and control structures from the top down. Future theater war will likely be rapid paced and information intensive.[21] The ability to gather and distribute certain types of intelligence information in real and near-real-time already exists. Although the information processing and distribution capabilities of CTAPS will be tremendously welcome, the structural problems of a command and control system designed to fight tactical war will persist. For example, a primary use of real-time intelligence will likely be for threat avoidance. A typical scenario might include information on a newly detected

mobile SAM site passing directly from sensor to aircrew, so to avoid the threat. Yet, as implied by the Air Force's centralized control doctrine, the decision whether to *strike* that particular SAM site will occur only after details pass all the way to the theater air component for validation and inclusion in a tasking order. So without somehow speeding up the entire process of targeting and mission planning, the organizational and structural problem of evaluating reconnaissance information and translating it into targeting objectives will force us to remain outside of the tasking cycle.

Even if CTAPS could react fast enough to exploit targets of opportunity fully, there is still the problem of opportunity costs. The costs of delaying attack on a previously assigned target may outweigh benefits of diverting sorties, but the air commander will have no way of knowing without a systematic approach to target valuation. He will still be faced with foregoing attacks on planned targets in order to react to targets of opportunity, at an unknown cost to the effectiveness of the air operation. Additionally, assessment emphasis on individual target strike results (the bottom-up approach to Battle Damage Assessment) will continue to mask the overall validity of target selections. The system will continue to confuse the *efficiency* of striking targets with the *effectiveness* of achieving the military objectives of the theater campaign.

A fundamental question for the future is how scarcity of air assets will alter conceptions of command and control requirements. Fewer aircraft may mean fewer total sorties, so there would likely be less friction due to overloaded C^2 structures (as occurred in Desert Storm). On the other hand, fewer sorties also underscore the importance of proper targeting. To a large extent, the sheer size of the effort in Desert Storm masked both the efficiency and the effectiveness of the implementation of Coalition air strategies. Yet, the trend of US Air Force operations continues toward higher sortie generation rates, and even faster operations tempo.[22] Regardless of the expected size of future air operations, command and control deficiencies must be remedied. The historical record shows that an air force's C^2 structure is crucial to its success in battle.[23] The US Air Force cannot afford simply to "muddle through" in an era of declining force structure and training budgets. The nature of the possible solutions to these problems is the subject of the final chapter.

Notes

1. *Gulf War Air Power Survey (GWAPS), Command and Control (U)*, 6–26. (Secret) Information extracted is unclassified.

2. Ibid., 7–48.

3. Gen H. Norman Schwarzkopf, *It Doesn't Take a Hero: The Autobiography*, with Peter Petre (New York: Linda Grey Bantam Books, 1992), 431–32.

4. *GWAPS, Command and Control(U)*, 7–48. (Secret) Information extracted is unclassified.

5. For example, Air Force Intelligence Command completed a major survey of intelligence and operations personnel in late 1992 and has instituted major changes based on the results. See Department of the Air Force, *Intelligence Requirements Survey—Phase I Final Report(U)*,

Washington, D.C.: Air Force Intelligence Command, 22 July 92, (Secret); and Briefing Notes, *Air Force Intelligence Command Intelligence Requirements Survey, Phase II(U)*, Washington, D.C.: Air Force Intelligence Command, 28 October 1992. (Secret) Information extracted from both sources is unclassified.

6. *GWAPS, Summary,* 12, 14. Interestingly, similar examples occurred during the Vietnam War.

7. ACC, *CONOPS for Theater C^{4}I*, Langley AFB, Va.: Headquarters ACC/XPJC, 11 March 1993, 2.

8. *Air Control System Quarterly 17*, 2.

9. ACCR 2-1, *Operational Doctrine: Air Operations*, 31 August 1992, 6-1, 6-2.

10. "Air Combat Command Concept of Operations for Theater Battle C^{4}I," Headquarters Air Combat Command/XPJC, 11 March 1993 and teleconference with ACC/DOY, 26 May 1993.

11. *Air Control System Quarterly 17*, 2.

12. ACCR 2-1, 31 August 1992, chap. 6.13. Ibid., 3-8. The strategic attack mission is excluded from the "Generic ATO Cycle" in Figure 3-1, while the traditional tactical missions are included.

14. *Intelligence Requirements Survey—Phase I Final Report* (U). (Secret) Information extracted in unclassified.

15. Message, 07/2230Z, Defense Intelligence Agency/DIW-4, MTIC Battle Damage Assessment Working Group, to US Military Intelligence Activities, *Approved Battle Damage Assessment (BDA) Terminology*.

16. Ibid.

17. For example, see USCENTAFR 55-45, "U. S. Central Command Air Forces Air Employment Planning Process," Draft, Shaw AFB, S.C., 1 April 1993, 5–11. The Targets Branch will provide "combat assessment (when available)."

18. *Intelligence Requirements Survey—Phase I Final Report* (U). (Secret) Information extracted in unclassified.

19. *A History of the Contingency TACS Automated Planning System (CTAPS) Program, Part One - Background,* Langley AFB, Va.: Headquarters Tactical Air Command, January 1991, vi–vii.

20. Ibid., II-8.

21. Memorandum for Secretary of Defense, Deputy Secretary of Defense, subject: Assessment of the Military-Technical Revolution (U), 15 July 1992, 22–23. (Secret) Information extracted is unclassified.

22. Ibid., 8, 15–16. Information extracted is unclassified.

23. Joseph G. Wohl, "Force Management Decision Requirements for Air Force Tactical Command and Control," *IEEE Transactions on Systems, Man, and Cybernetics* 11, no. 9 (September 1981): 619–20.

Chapter 6

Recommendations
Toward Future War

. . .our reconstitution strategy focuses on supporting our national security policy to preclude the development of a global threat contrary to the interests of the United States. Should such a threat begin to emerge, we would use available lead time to forestall or counter it at the lowest possible levels of militarization.

—Secretary of Defense Dick Cheney
White Paper, January 1993

This study has examined historical influences on the Air Force's command and control for conventional war and has produced some definite conclusions. However, they are merely starting points for progress toward correcting some of the deficiencies identified here. The Air Operations Center inherited a legacy of a divided command structure from the Vietnam War, a legacy that remains imbedded in its organization for fighting conventional air war. The C^2 problems identified in the Persian Gulf War highlight the importance of this observation. In that war, the United States and its allies had both qualitative and quantitative advantages so pronounced that, in retrospect, it seems hard to imagine any other outcome. In the next war, the US may not be as fortunate. The next aggressor may not stand idly by and wait while America builds up her forces. As a result of reductions in force size, readiness and procurement, the Air Force will need to make every sortie count.

Yet so long as the current conceptual foundations for C^2 remain, commanders who want to attack targets of opportunity will face the dilemma of either diverting a sortie from a preplanned target or waiting for the next cycle. Additionally, the Air Force's traditional "bottom-up" approach to assessment will continue to frustrate efforts to evaluate his results. In order to reshape the AOC into a responsive means for conducting air war, the Air Force must solve these two fundamental problems.

Solutions for Reducing the Conflict between Cycle Time and Responsiveness

The AOC must improve its ability to attack strategic targets rapidly, just as its predecessor improved responsiveness for tactical targets. One strategy would be to shorten the mission planning/execution/assessment cycle time.

Commanders are already attempting to do this, but the usual approach is to try to move data faster. CTAPS and other technical improvements will shorten data transmission times. But much more can be done. To be truly effective, the AOC must not only communicate information faster, but must allow planners and aircrews the time they need to plan and execute a well-thought-out mission.

In each phase of the mission planning cycle, the commander can improve responsiveness. First, during the location, identification, and analysis phase, Combat Intelligence (with assistance from national resources) must use the time before hostilities commence to conduct preanalysis of likely target sets. The Air Force must learn to preanalyze the enemy's war-making system in strategic conventional war, just as it has learned to do for a projected nuclear war. Not only must enemy target systems be identified and prioritized (which intelligence structures can do well now), but additional methodology must be developed for predicting the importance of targets over time. Targeting is a dynamic process—a target's value periodically changes. Just as tactical targets vary in importance with time, operational and strategic-level targets change value with time as well. The AOC must develop and formalize methods for predicting this time-change of target value.

If the air commander is provided with educated predictions of how targets and target systems will change value over the course of the campaign, he can grapple effectively with the question of opportunity costs incurred by foregoing individual elements of the target system set. Simply because a target is fleeting doesn't make it valuable. The commander must evaluate *all* effects of diverting sorties from their primary targets on his overall air campaign, to include not only friction associated with reshuffling support aircraft, but also loss of mission effectiveness and lowering of probability of survival. He must resist the impulse to go after a real-time target simply because he may "lose" it. Until he has better analysis for predicting target value changes, air commanders may be better off in the long run by ignoring the temptation to strike every target that becomes visible. As one researcher noted in 1975,

> The concept [of opportunity targeting] assumes that any target identified by real-time or near-real-time reconnaissance is worth the expenditure of air power to destroy or neutralize it. It presupposes an abundance of strike aircraft which would allow a response to every sighting, but like betting all the combinations on a roulette table to insure some sort of payoff on one spin of the wheel, the cost of the bets easily offsets any winnings realized.[1]

Once the commander has a clear idea of the value of target systems and how they are changing with time, he needs to be able to take advantage of opportunities without jettisoning his well-crafted plan. Alert or Rapid-Reaction Forces offer greater responsiveness to near-real time tasking without many of the disadvantages of either diverting sorties or deferring targets to the next planning cycle. Commanders could designate a greater portion of their forces to respond to targets of opportunity. The concept is similar to air defense alert, where aircraft and crews are held in readiness for short notice tasks. These missions could be "general support"—multipurpose

aircraft with multipurpose munitions.[2] Or, the commander could task specific airframes and weapons, for example, Stealth loaded with penetrating bombs. To avoid the problem of "losing" the sortie if no opportunity target becomes visible during its cycle, the mission could have a preplanned target that is relatively non-time-critical. This technique was used occasionally for strategic missions in the Gulf War. The disadvantage of this scheme is that ordinarily, force-multipliers such as tankers and electronic support aircraft must support several strike packages, so often there is a scarcity of resources to support alert taskings. But preplanned alternative routes, tanker tracks, and package coordination for the alert missions could greatly increase the chance of success without tying up limited resources.

Another objection is that "a sortie not flown is a sortie lost." This argument is specious.[3] Even if a maximum effort is needed, a set of new alert aircraft, including the supporting aircraft (if required), could be generated before the launch time period for the previous alert mission expires. The commander could then launch the first set either toward their preplanned fixed target, or to an airborne command aircraft for assignment to a tactical target. In addition, an alert force from a composite wing could greatly reduce coordination difficulties for large strike packages and minimize friction, since all the strike and supporting assets are physically collocated. If the commander expects opportunity targeting to be an important part of his plan, dedicating deep strike packages to an "operational reserve" makes sense.

To enjoy the same advantages that a well-planned strike mission has against an unprepared defender, some sort of onboard mission planning is essential for both alert aircraft and diverted sorties. Flexible mission planning systems are now being introduced into squadrons throughout the Air Force. It is not a far leap of imagination to envision miniaturizing these systems and placing them on board aircraft, so that the time between launch (or even engine start) and weapons on target can be productively used to shorten the overall response time. Here is a technical solution that is relatively easy to implement, but would have the potential for dramatically increasing the probability of mission success.[4] In any event, similar capabilities will be required to transmit real-time and near-real-time intelligence to the cockpit for threat location and avoidance.

Probably the most potentially controversial recommendation is that the Air Force consider decentralization of some execution decisions, since the organization has long been wedded to the doctrine (some say dogma) of centralized control. Decentralized decision making has great potential for increasing responsiveness. The commander could issue mission-type orders and "commander's intent"—the "why" of the commander's priorities—and allow lower echelons to make the attack decision. This might be particularly effective for strategic conventional attacks, where targets are often fixed installations not subject to the same fluidity of movement for tactical level targets. Delegating a target system or sets of individual targets to a single unit would result in a more methodical and thorough campaign. The unit would be focused on the target set, and would likely have better continuity of

effort within its particular guidelines. Much of the assessment of their effort could occur within the unit, which would spare scarce theater reconnaissance systems to identify and task surviving targets.[5]

Decentraliztion would allow wing commanders to react faster to retaskings and targets of opportunity. Rather than information traveling all the way up to the air component commander for a decision, a reattack could be decided at a lower level, since subordinates would understand the commander's priorities, thus speeding destruction. This would also allow the theater-level air commander more time to concentrate on critical aspects of his plan. In fact, issuing mission-type orders and commander's intent to subordinate units can assist the commander in conceptualizing his air strategy in a changing environment. Communicating a clear daily mission statement, along with intent—the "why" of the air strategy—would help the commander to articulate his air operation plan in the heat of the struggle. Finally, limited decentralization would improve the robustness and survivability of the air commander's plan. If a wing commander knew what the JFACC wanted for the next three days, for instance, the wing would continue to prosecute the war according to plan, even if the AOC were destroyed or communications were disrupted.

Limited decentralization is probably most appropriate for conventional war, since many efforts are being conducted simultaneously and some mistakes can be tolerated. Decentralization is *not* appropriate for raids and demonstrations of force, where a specific political result is vital and mistakes not tolerable. Also, limited decentralization will require training subordinates how to make operational targeting decisions. One could argue that overcentralization at the theater level has encouraged atrophy of strategic thinking in commanders at wing level and below. Limited decentralization in exercises as well as war would provide training our future air commanders need to make operational and strategic judgments. However, the main benefits remain responsiveness and survivability. As one squadron commander who flew in Desert Storm noted, "Mission-type orders are the laxative for constipated communications."[6]

Some of the solutions to the responsiveness problem may change with the types of targets themselves. For example, some targets will be fixed or relatively immobile. These may be good candidates for the air commander to set priorities, give his intent, and then assign general sets of these targets to wings for decentralized control and execution. Other targets will be traditional tactical targets, where "kill boxes" or other geographic control measures will be the primary method of control. For example, missions assigned to a general area may receive final aim points en route to the target area. In this instance, a provision for onboard mission planning may be imperative, in order to respond to short-notice real- and near-real-time targets. Indeed, a commander could create his own opportunities by planning for his Alert Force to follow a specifically tasked reconnaissance sweep. This type of attack may be suitable in a situation where the target system's function is well understood, but specific aim points are elusive or difficult to

identify. In this way, the commander could preplan a mission incorporating near-real-time intelligence. The reconnaissance asset could provide final target identification and location to an alert strike package already en route. The point is that there are several alternatives for making strategic attacks more responsive to opportunities, other than simply speeding communications in an older conceptual framework. Gleaning lessons from the decentralized execution processes of the responsive ground-support function should improve responsiveness in planning and executing conventional air war across the entire spectrum of targets.

Solutions for Reconnecting Assessment to Military and Political Objectives

To have worthwhile measures of effectiveness, assessment planning must begin in the earliest stages of analysis and planning. The concept of target systems is fundamental to this vision of air war. We must focus on the effect of neutralization of the target systems, not on the individual targets themselves. Therefore, the air commander should have a realistic plan for measuring how well air operations are accomplishing the theater commander's military objectives. There is nothing new about this idea. Intelligence directives note the importance of planning assessment in the early stages of the targeting process.[7] The problem is that the "assessment" discussed is bottom-up assessment. Examination of the effects of strikes on individual targets provides little guidance on what to do should those "successful" attacks fail to achieve campaign goals. One way to determine overall effects would be direct measurement of degradation of the target systems, or a "top-down" approach to assessment (fig. 13).

Direct measurement of air power effects on target systems, rather than on targets, should become a priority for theater air intelligence. The top-down approach to mission assessment will validate the translation of military objectives to the target sets themselves, by making apparent the link between the ATO and the commander's objectives. For example, one of the commander's objectives might be the disruption of the enemy's ability to communicate with his forces. One could destroy every communications node identified, but if the enemy has other, unidentified means, he could still have 100 percent capability of communicating with his subordinates. The only valid way of assessing achievement of this goal is to measure his communications traffic directly.

Certainly, the absence of communications traffic is a more accurate measure of effectiveness than counting the number of constituent subcomponents destroyed (how do you know these are the only nodes?). Direct measurement will not only assess the effectiveness of the missions flown against the set, but will assess the extent of achievement of the commander's objective as well. Here is another example: the air commander cannot truly measure his effectiveness

Figure 13. "Top-down" Assessment

against an enemy's electrical power distribution system by counting the power plants destroyed, because the enemy may have back-up generators which are not known or are not vulnerable to attack. But if there were a method for measuring directly the current flowing through the enemy's power grid, the air commander would know when his goal had been accomplished, and thus, when to move on to other targets. Conversely, if air power has destroyed every one of the enemy's power plants and switchyards, and yet reconnaissance still detects electricity, the commander knows he must either find other electric system targets to attack, or devise an alternative strategy.

How could one directly measure the effect of attacks on the enemy's target systems? Actually, the USAF has done this in the past. In Korea, aircraft maintained tight surveillance over the enemy's supply routes and were able to directly measure logistics traffic into the theater.[8] Though Fifth Air Force was unable to conduct a successful interdiction campaign during this time, its assessment of its own effectiveness was accurate—not much good.[9] A more recent example was Desert Storm. Although Coalition air forces destroyed only a portion of the enemy's aircraft and had reduced, rather than shut down his airfield operations, they nonetheless achieved air superiority by the tenth

day of the war.[10] The enemy wasn't flying. Had commanders only counted individual aircraft destroyed, they never would have gotten an accurate picture. Other effects, however, are more difficult to measure. For instance, how does one know when the enemy's electrical grid is truly inoperative? He may have electricity but is keeping the lights turned off for deception purposes.

Therefore, Air Combat Command may need to generate requirements for new assessment capabilities. One reason for not having a satellite or aircraft that can measure electrical current in transmission lines may be that no one has asked for it. Top-down assessment requires a new way of thinking about assessment. The Air Force has been wedded to the methods developed in Vietnam for so long, change has been stymied. Also, top-down assessment may be considered either too costly or beyond current capability.

One way to measure effects on target systems directly might be to use Air Force Special Operations Forces. The purpose of these forces is to conduct "air operations that influence the accomplishment of strategic and tactical objectives [and are] usually conducted in enemy controlled or politically sensitive territories."[11] Rather than assessing the results of individual strikes, these forces could directly measure the target system of interest to determine effectiveness of strikes. In fact, assessment could become an important mission for Air Force unconventional forces. Combat assessment requires an understanding of the concept of target systems. Airmen recognize that, in the example above, denying the enemy electricity is the goal, not destroying power plants. In any case, top-down assessment can provide a true measure of how well our air operations have achieved the commander's military goals, and the Air Force must make a major commitment to achieving it.

AOC assessment personnel can be tremendously valuable in validating the objective-to-ATO translation. Theater-level Air Force intelligence should be the primary agency for measuring effectiveness of strikes based on this top-down approach. Other intelligence organizations can support this effort by operating systems and fusing sources which can support this goal. The operational wings have a multitude of personnel dedicated to assessing success against individual targets—the aircrews themselves. The most important measure of effectiveness at wing level is the individual's perception of his effectiveness against the target. Most bottom-up assessment functions can, and should, be delegated to the wings. While some theater-level personnel will be required to check the quality of target assessment produced by the wings, the majority of work can be delegated to the lower echelons. With increased reliability and lethality of weapons, and increasing availability of onboard video, many target assessments can be input to the system by the individual units. Additionally, a system like CTAPS will help speed data flow from wings to the AOC, to be fused with other, top-down assessment products. Target assessment will continue to be important, but primarily to wing-level planners. They will want to know if individual targets, especially enemy defensive systems, have been destroyed, in order to plan missions. In fact, with increased delegation will come an even greater need for "lateral" information flow. For example, the wing will want to know if some

other unit has struck a target already. What were the defenses? When was the last time the target was attacked? This concept makes wing-level target assessment even more attractive, since such information can go directly out to other wings rather than up to the AOC first, thus further reducing mission planning time. In addition, theater-level assessment personnel will have more time to perform their vital function of supporting the JFACC with overall mission assessment.

Most importantly, the Air Force simply may not be able to afford to divert so many scarce reconnaissance resources to ascertain if individual targets have been neutralized. Although the limitations of onboard video and aircrew reports will require some external imagery to determine attack results, many of these resources can be better used assessing direct effects or searching for new targets. The lethality of modern weapons and better peacetime training have drastically raised the probability of killing individual targets.[12] Improved weapons reliability and better preanalysis of the dynamics of the expected air war may allow planners to more confidently predict expected effects, even considering fog, friction, and enemy opposition, reducing the need to obtain assessments of individual targets. Scarce intelligence assets could then be refocused on determining the validity of the target sets and overall military effects, rather than merely confirming the results of strikes on individual aim points.

The ultimate goal of assessment would thus be to evaluate the effect of neutralizing the various target systems on the enemy's overall war-making capability. Emphasizing mission-level assessment early in the C^2 cycle will force planners to think about the connection between target systems and military aims—"why" they should advocate attacking a particular target system, not simply its composition and function. Thoughtful strategy making requires a clear vision of the *mechanics* of the enemy's defeat. The commander may believe that the cumulative effect of various military actions may bring about his foe's collapse through sheer weight of effort—but belief alone is merely supposition. What if military objectives change? What if the enemy does not behave as expected? What if new alliances form, or old ones fall apart? Without a concrete understanding of the desired causes and effects—the mechanisms for victory, that connect military acts with their ultimate outcomes—a commander may well find his actions producing undesirable and contradictory results. Thus, mission assessment provides the commander with a true measure of his effectiveness by constantly reevaluating the chosen strategy (fig.14).

The ultimate top-down evaluation would be to answer the question, "How is the collapse of this target system helping to achieve the military goal?" Direct measurement of targeted systems will provide clues to the effectiveness of the entire campaign. While it may be impossible to objectively gauge overall progress toward victory until the military objectives have been accomplished, indication that the strategy is working could come earlier with major changes in the enemy's behavior. These changes are often seen at the tactical level of war. For example, once daylight interdiction missions began to take a heavy

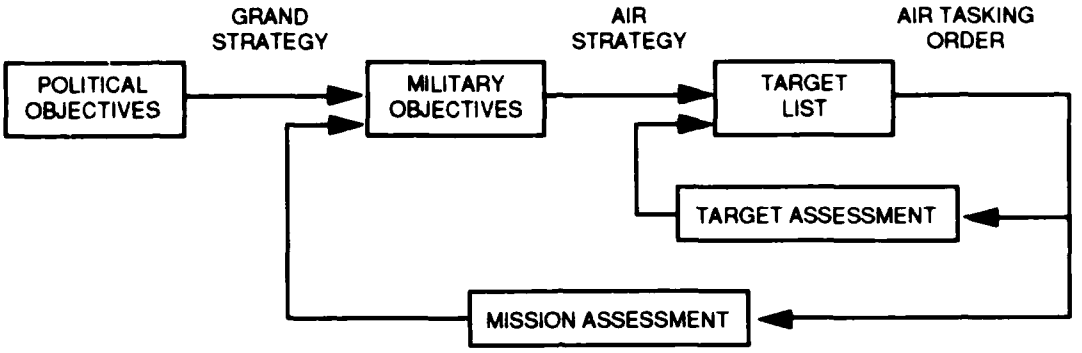

Figure 14. Mission Assessment

toll. Communists in North Korea switched to night convoys. Behavioral change can occur at the strategic level as well. The German economy continued to produce armaments while on the verge of collapse, but German drivers had begun fueling their cars with charcoal.

Therefore, combat assessment really begins with the formulation of strategy. Strategy must be grounded in a sound analysis of the enemy's war-making system, not only as it exists at the beginning of the campaign, but as it will likely react under the stress of air attack. To have a reasonable chance of predicting the opponent's reactions, this analysis must also look at the world from his political, economic, military, ideological, social, and cultural viewpoint.[13] Then, to an air commander having a comprehensive understanding of both the mechanisms for achieving victory and his foe's probable work-arounds, major shifts in enemy behavior can indicate effectiveness of the air effort. If targeted systems are collapsing, but no behavioral change occurs, either in terms of battlefield outcomes or effects at home, the predicted means of the enemy's defeat must (and will) be reexamined and adjusted. Conversely, changes in enemy activity foreseen by the air strategist may provide evidence that the air operation is achieving its goals.

Conclusion

Centralized control of air operations is a means—not an end. Rather, informed and intelligent unity of effort toward a common objective is the goal. Somehow, in its quest for more efficient use of air power during the war in Vietnam, the Air Force lost "the big picture." Improvements since the 1970s have merely added capability to the same core design. While rapid advances in information technology have made C^2 more efficient, one cannot assume that data processing and distribution capability will solve command and control problems. Although new systems will greatly assist the commander to analyze and control the progress of the air campaign, without an understanding of how those systems support the translation of political aims

to military means, they are efficiency improvements only. Air Combat Command must frame future C^2 system requirements in terms of new tasks, rather than simply the more efficient execution of current tasks. Current "requirements" such as responsiveness, survivability, redundancy, data storage capacity, and so forth, are vital, but only after the *fundamental* needs are defined.

The Air Force must resolve the conflict between mission planning cycle time and responsiveness if commanders are to be able to respond knowledgeably and effectively to opportunity targets. Intelligence must change the current efficiency-oriented assessment system to an effectiveness oriented system. These are primarily doctrinal and organizational problems, not technological ones. Airmen—not statesmen, politicians, or even soldiers—must reestablish the connection between target sets and military and political aims, while exploiting potential opportunities offered by the domination of information. Changing the *name* of a command and control structure is not enough—the flawed system the Air Force built must change as well.

Notes

1. Maj Robert T. Saginario, "Tactical Intelligence and the Real Time and Near Real Time Sensor Input" (Thesis, Air Command and Staff College, Maxwell AFB, Ala., May 1975), AUL MU 35582-7 S129t, 32.

2. A new generation of cockpit-selectable weapons is currently under development at the Air Warfare Center. The concept is to select a fuze setting while in flight which would produce the desired effect (blast, fragmentation, incendiary, penetration) based on mission requirements.

3. John A. Warden III, *The Air Campaign: Planning for Combat* (Washington, D.C.: Pergamon Brassey's, 1989), 102.

4. Obviously, technical solutions *per se* are neither "good" nor "bad." The difficulty lies in integrating technology with the proper doctrine and organization in order to fully exploit its advantages. See M. L. Metersky, "A C^2 Process and an Approach to Design and Evaluation," *IEEE Transactions on Systems, Man, and Cybernetics* 16, no. 6 (November/December 1986): 880–89.

5. A detailed discussion of this concept follows in this chapter.

6. Lt Col Pat ("Doc") Pentland, 510th Tactical Fighter Squadron.

7. AFR 200-1, *Intelligence: Air Force Intelligence Mission and Responsibilities,* Washington, D.C.: Department of the Air Force, 14 June 1984, 3–4.

8. Robert F. Futrell, *The United States Air Force in Korea: 1950–1953,* rev. ed. (Washington, D.C.: Office of Air Force History, 1983), 437.

9. Col R. L. Randolf and Lt Col B.I. Mayo, "The Application of FEAF Effort in Korea, 1952," staff study, AFHC K720.1, 12 April 1952, 14.

10. Department of Defense, *Conduct of the Persian Gulf War, Final Report to Congress* (Title V Report), vol. 1, Washington, D.C.: Government Printing Office, April 1992.

11. AFM 2-10, *Special Operations,* 25 October 1991, 3.

12. Gen Michael Dugan, "The Air War," *U.S. News & World Report,* 11 February 1991, 28–29.

13. Pentland stresses the importance of looking at the enemy's system as dynamic, and his power as including ideological and social/cultural elements besides the traditional components of national power.

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